SCIENTIFIC AMERICAN

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1. The college building. 2. Kindergarten. 3. Physical laboratory. 4. Geological laboratory. 5. Chemical laboratory. 6. Art studio. 7. Machine shop. 8. Woodworking shop.

THE TEACHERS' COLLEGE, MORNINGSIDE HEIGHTS, NEW YORK CITY.—[See page 135.]

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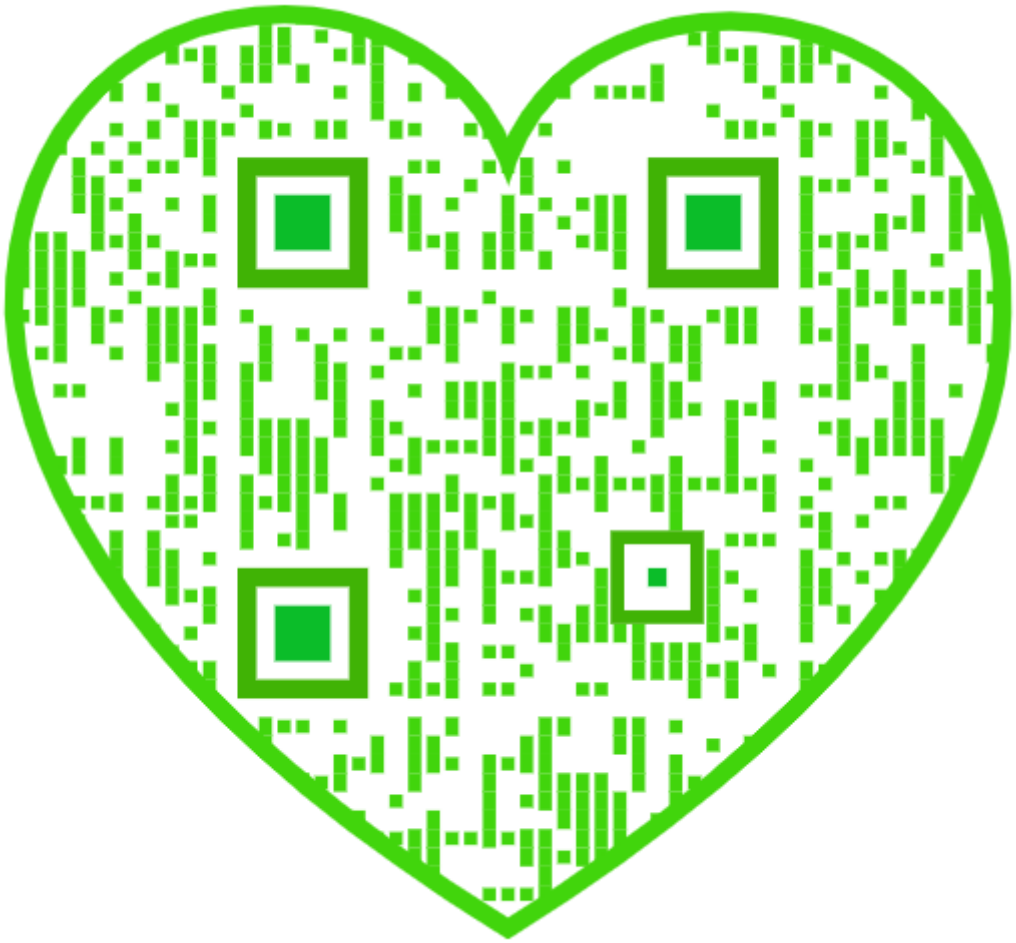

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REPORT OF THE COMMISSIONER OF PATENTS FOR 1894.

The report of the Commissioner of Patents for the year 1894 is in some respects one of the most interesting presentations yet issued from the Patent Office. The reports of the business of the office show that there were granted 20,803 patents, including designs, while there were 38,344 applications for the same. Counting trade marks and reissues, there were 40,492 applications, 12,920 patents expired and 3,812 were forfeited for non-payment of the final fee. The total expenditures were $1,100,047.12, and the excess of receipts over expenditures was $87,392.46. In the Treasury of the United States there is now a balance of $4,369,135.91 to the credit of the office.

Connecticut, with one patent to every 993 inhabitants, was the most inventive State, Massachusetts, with one patent to every 1,335, coming next. At the foot of the list is South Carolina, with one patent for every 25,581 inhabitants. Of foreign countries, England, with 689, and Germany, with 582 patents granted, head the list.

The commissioner describes the methods of the office during the year. A great effort has been made to bring business up to date, and at last it has been accomplished, so that on December 31, 1894, there were but 2,273 new applications in the office which had not been acted on, and no division was more than thirty days in arrears, either on new or on amended work. On the same day 50,507 cases were pending in the office; of these, 12,000 had been pending two years or more, 1,514 five years or more, 130 ten years, and five had been pending fifteen years.

This long pendency of applications indicates often intentional delay, the idea being in some cases to delay the issue of the patent until the art is more fully developed. To prevent this abuse the commissioner proposes to put in force after April 15, 1895, a new rule to the general effect that only six months' delay in making each amendment will be tolerated on the part of applicants, and where cases have been pending for five years or more the applicant may be required to show cause for his delay, and failing in this, his case will be subject to rejection. The last clause seems to be an echo of the Berliner telephone decision. Exactly how the six months' rule can be enforced in the light of the two year period presented by section 4,894 of the patent statutes does not appear, or is not explained in the report.

While the Berliner case is applied to the prevention of delays in prosecution, the portions of the decision touching on the administrative character of the Patent Commissioner's functions are not laid to heart. The ambition of the present commissioner is apparently, by examining all possible references, to grant patents which in a very high percentage of cases will be held valid in the courts. To make this result attainable the office is working on such references, to make what is termed the "perfect classification of this vast material," such material being the 541,571 United States patents, 864,700 foreign patents, and the printed publications of all countries. How any approach to a perfect classification of the vast body of material can be made is a problem nearly unsolvable. A special increase of appropriation of $64,590 is asked for on behalf of this work. It is evident that there is no tendency to greater liberality in issuing patents; the tendency is in the opposite direction. In the law every man is assumed to be innocent until he is proved to be guilty—patent applications seem considered to be for invalid inventions until proved to be for valid ones.

It would be interesting to know how the business of the office has been so expedited—whether it has been by too severe a treatment of applications and by too strict an interpretation of the statutory requirements of invention and novelty. We have repeatedly maintained that the public would be better served by a liberal administration of the Patent Office. An applicant should be treated as entitled to a patent at least prima facie. The granting of an invalid patent does little harm, while the refusal to grant one which, seemingly invalid, would ultimately prove valid, may do the inventor and the community the greatest injury. The old time jurists of the United States held that the inventor was to be encouraged and fostered by the state. The pendulum, however, began to swing the other way and the Supreme Court declared many patents invalid, practically threw out reissues and gave the Patent Office every pretense for illiberal treatment of applicants for patents.

In the courts the pendulum seems to be on its return swing, and patents are again favorably adjudicated on. It is to be hoped that the Patent Office will ultimately take a more favorable view of the claims of the country's inventors. Such important and difficult topics as statutory invention, and degree of invention, and the subjects in general of the patent statutes, the "metaphysics of the law," as they have been termed, deserve adjudication in the highest and most competent courts. The Patent Office examiner presides at too low a tribunal for the determination of such intricate questions as arise in the granting of letters patent.

THE CAREER OF A CHEMIST.

Through some influences similar to the article "On the Choice of a Career," in the issue of the SCIENTIFIC AMERICAN of January 19, my father was persuaded to let me—or make me—study chemistry. I was sent to Germany and passed two years under one of the leading analytical chemists and then two years at a university, devoting my time to the study of organic chemistry. After graduating, I returned as assistant to my old teacher, and through his influence I obtained a position in one of the leading establishments in Germany. There I passed three years, one year in the laboratory and two years overseeing the work done outside.

Here I obtained a thorough knowledge of the manufacture of soda, sulphate, causti soda, alum, the acids, bleaching powder, etc.

About this time my father concluded that my education had been completed far enough for America and called me home—home to a city of 40,000 inhabitants, in which there was not one single establishment employing the aid of chemistry, directly or indirectly. My father himself knew nothing about chemistry, excepting that he had read of the success achieved now and then by some chemist in various parts of the world. He simply expected me to discover something new and to become famous and rich in a few months.

After awhile, however, I obtained a position as chemist in one of the largest American establishments, attending to laboratory work and partly supervising the manufacturing processes.

After five years I had an opportunity to fill a better salaried position. This I accepted, and remained in my new position for four years. Then the entrance of the owner's son into the factory deprived me of my position. I have tried to obtain a new one for the last eight months, but in vain. I am conversant with the processes used in making all the leading chemicals, have made many of them myself for years, but can find no one who wants my services.

Through my training and schooling I am locked out of every other business almost. I am no bookkeeper, I know perhaps as much about pharmacy as the average druggist, yet I cannot accept a position as druggist. I cannot enter a shoe store as clerk nor can I work as stevedore along the wharves.

I cannot follow your advice, "Select a process, study it, find out its weak point, and endeavor to improve that. In this way your opportunity will come." To do this requires money, and I cannot afford to devote more money to studying out a process that may or may not bring in financial returns. I must strive to draw returns out of the knowledge I possess at present, knowledge gained at the schools and in practical work in some of the leading establishments in Germany and America, and to devote this knowledge in working out processes for my employers.

Before undertaking the study of chemistry, the student should ask himself the following two questions:

1. Can I, after finishing my studies, devote a certain number of years and a certain capital to farther research?

2. Must I enter the service of others after finishing my studies?

The chemist must pay more for his education than the minister, the lawyer or the physician. These last three can settle down in any village or town and gradually build up a living, according to their attainments. The chemist, however, provided he is not a man of means, finds thousands of towns and cities in the Union closed against him, because there are no chemical works in them.

If, perchance, he obtains a position as chemist in a town of any considerable size and loses it, he can do nothing else but leave the town, as it is highly improbable that there will be a suitable second opening for him there.

The chemist cannot go into any village by chance and grow up with it as the physician can; he cannot build up a practice like the lawyer, or a congregation like the theologian. He must either enter the employ of some manufacturing concern or he must start an analytical laboratory in some of the large cities, or he must have the means to enable him to devote his time to private independent research. These points must be considered in discussing the question propounded by you "On the Choice of a Career." J. G. L.

Jersey City, N. J.

THE HEAVENS IN MARCH.

The celestial stage this month will present Diana playing a role in which she was once accustomed to terrify mankind. And even to-day the earth contains millions of Adam's descendants who look upon a total eclipse of the moon with awe and dread. But knowledge does not diminish the interest of such an event. It is a wonderful thing to watch the shadow of our planet creeping across the mountainous face of a globe nearly 240,000 miles away. The scale of such a phenomenon is in itself imposing to the imagination. And we like to see our shadow reaching so far; it heightens our respect for the ball that casts it. There should be

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a perceptible increase of human dignity after an eclipse of the moon.

This eclipse will occur on the night of Sunday, the 10th, and will be visible throughout most of the inhabited regions of the globe. I believe there are still tribes in Africa who will beat tom-toms and fire guns to drive off the shadowy monster that is trying to smother the moon. The gunpowder of civilization travels so much faster than its astronomy, and is so much easier to understand.

Below, in Eastern standard time, are the elements of the eclipse:

Moon enters penumbra	7:57	P. M.
" " shadow	8:53.7	"
Totality begins	9:51.5	"
" ends	11:27	"
Moon leaves shadow	0:24.8	A. M.
" " penumbra	1:21	"

It should be remarked that the ordinary observer is not likely to notice the penumbral phases, and, putting the whole thing in a nutshell, it may be said that the eclipse will begin about 8:54 P. M. and end about 0:25 A. M.

One interesting feature that all can easily observe is the color of the moon when it is completely under the shadow. Probably the color will be a copper-red. This is due to the refraction or bending of sunlight around the edge of the earth by the atmosphere. If we could see the earth from the moon during the eclipse, we should most likely behold a luminous red ring surrounding it, the color being due to absorption of light by the atmosphere. Occasionally, however, the moon does not look red during an eclipse, but almost disappears from sight, what can be seen of it presenting a faint, dusky appearance. This may be owing to the presence of clouds in the earth's atmosphere which prevent the transmission of light.

Among the planets Venus is fast coming to the front rank. Every eye must notice the gleam of her silver lamp, low in the western twilight, rivaling the brilliance of Jupiter overhead. At the opening of the month she will be in the edge of Pisces, just above the tail of Cetus, and will set about 7:30 o'clock in the evening; at the end of the month her place will be in Aries, directly over the head of Cetus, and then she will set about 8:30 P. M. She is not yet a very interesting telescopic object, the form of her illuminated disk being that of a gibbous moon.

Mars appears very insignificant in comparison with its splendid aspect last autumn. During the month it will move eastward in Taurus from the neighborhood of the Pleiades to a position nearly midway between the "golden horns" of the celestial Bull. It transits the meridian between 4 and 5 o'clock in the afternoon.

Jupiter remains in Taurus above the point of the southern horn, brightly tipped with the star Zeta, but by the end of the month he will have retreated across the border into the territory of the Twins, where he will take up a position just northeast of the star cluster H 1325, and a little west of the still greater cluster M 35.

With the telescope Jupiter is an object of unceasing interest. Following are a few phenomena of his satellites. The fifth satellite is, of course, far beyond the reach of the amateur.

On March 12, at 6:48 P. M., satellite III will disappear behind the planet, and will reappear at 9:43 P. M. At 8:38 P. M. satellite II will also disappear by occultation behind the planet, and when it reappears, at 1:49 A. M., it will come into sight not far behind the edge of the planet, but out of the latter's shadow, at a considerable distance from the planet. At 9:36 P. M. on this same eventful night, satellite I will pass upon the planet's disk. Its shadow will follow at 10:53 P. M., and will be half way across at midnight.

On the 21st, at 5:59 P. M., satellite II will pass upon the disk of the planet. Its shadow will follow at 8:32 P. M., and will be half way across before 10 o'clock. On the same evening, and at the same hour, 5:59, satellite I will pass upon the planet's disk, nearer the equator. Its shadow will follow at 7:17 P. M., and will be half way across by 20 minutes past 8 o'clock. If a telescope that will show both the shadows is used, it will be very instructive to watch their comparative rate of motion. Satellite I, being nearer the planet, moves much faster than satellite II. A more powerful telescope is required to see the satellites themselves on the disk of Jupiter.

The above are Eastern standard times. Subtract one hour for central time.

Saturn is nearing a position where it can be conveniently observed. During March it will be near the border of Libra and Virgo, passing into the latter constellation near the end of the month. It will then be two or three degrees southeast of the star Kappa Virginis. At the close of March Saturn will rise about 8 P. M.

Uranus remains in Libra, making an isosceles triangle with the stars Alpha and Beta. It is nearer to Alpha, and about two degrees north-northeast of the fourth magnitude star Iota.

Neptune is in Taurus, near the fifth magnitude star Iota Tauri. Mars will be in conjunction with it at a distance of 3° north on the 25th.

Mercury is a morning star and will reach its greatest distance from the sun in the morning sky on the 24th.

The month opens with a crescent moon. The moon attains first quarter in Taurus on the morning of the 4th; fulls in Leo on the night of the 10th, and reaches last quarter in Sagittarius at midnight on the 17th. It is in perigee at 7:30 P. M. on the 9th, and apogee at 1:30 A. M. on the 22d. New moon occurs at 5:25 A. M. on the 26th.

The moon's planetary visiting list for March is as follows: Conjunction with Mars on the 3d at 10 A. M.; with Neptune on the 4th at 8 A. M.; with Jupiter on the 5th at 6 A. M.; with Saturn on the 14th at 7 A. M.; with Uranus on the 15th at 5 A. M.; with Mercury on the 23d at 5 P. M.

There will be a partial eclipse of the sun on the 26th, visible in Greenland, but not in the United States.

The sun enters the sign Aries and the astronomical spring begins on March 20 at 4 P. M.

GARRETT P. SERVISS.

Dr. A. L. Loomis.

Dr. Alfred L. Loomis died at his New York home January 23. Dr. Loomis was one of the most widely known of New York physicians. Dr. Loomis was born in Bennington, Vt., on October 16, 1831. He graduated at the College of Physicians and Surgeons in 1852. He was early recognized as a specialist in pulmonary and heart troubles; for two years he was an assistant in the hospitals on Blackwell's and Ward's Islands. In 1859 he was made visiting physician at Bellevue, and 1862 lecturer on physical diagnosis at the College of Physicians and Surgeons. For thirty-five years Dr. Loomis was connected with the Bureau of Charities and Corrections, and his aid and advice were always sought and heartily given in the promotion of everything calculated to elevate the character of the hospitals and other institutions of the department, and to alleviate the sufferings of the inmates. Dr. Loomis was consulting physician to numerous hospitals and a member of several medical societies. In 1886 an unknown friend of the New York University gave, through him, $100,000 to build and equip the Loomis Laboratory, which already has an extended reputation for its bacteriological work.

He was Professor of Pathology and the Practice of Medicine in the University of New York since 1886. He devoted great attention to hygiene and was never in favor of giving much medicine. Among his publications are "Lecture Introductory to the Course of 1871-2 in the Medical Department of the University of the City of New York;" "Lessons in Physical Diagnosis," 1872, ten editions up to 1893; "Diseases of the Respiratory Organs, Heart and Kidneys," 1875; "Peritonitis," 1875; "Lectures on Fevers," 1877; "Diseases of Old Age," 1882; "A Text Book of Practical Medicine," 1884; also, "Climatic Treatment of Pulmonous Phthisis;" "Physical Exploration of the Abdomen;" "Physical Signs of Diseased Conditions of the Liver and Spleen;" and "On the Use of Opium in Acute Uræmia and Convulsions."

By his paper on "The Adirondack Region as a Therapeutical Agent in the Treatment of Pulmonary Phthisis," he paved the way for opening the North Woods as a health resort. The entrance to Bellevue Hospital will be draped in mourning for thirty days, and a commemorative tablet will be placed upon the walls of the medical board room of Bellevue Hospital in honor of him.

Importance of the Eucalyptus Tree to California.

The eucalyptus tree promises to become in time almost as useful to California as the bamboo is to Japan and China. During the past twenty years the eucalyptus has been introduced very extensively throughout the central and southern parts of the State. The eucalyptus tree may be put to many important uses. It has the advantage of requiring little or no attention and of growing with astonishing rapidity. In the vast timberless regions of California it has been an important factor in improving the land. The wood brings a good price when sold for fuel and it is generally acknowledged to have, besides, many valuable medicinal qualities. The eucalyptus is also extensively used to form a windbreak about Californian gardens and orchards.

It has been found very profitable to raise the eucalyptus tree for fuel. The tree's remarkably rapid growth makes it possible to raise a crop or forest of these trees to a size suitable for cutting every three years. Within a year from the time the seed has been planted the tree often reaches a height of ten feet, and a height of fifty feet in three years. It is customary to cut the tree off about two feet from the ground, at intervals of from three to five years. The trees are then cut into cord wood. During the past year the wood is reported to have brought from $6 to $9 per cord. A fair profit from such a crop is thought to be about $50 to the acre. It is estimated that a single acre, if left untrimmed for eighteen years, would, at this rate of growth, produce $10,000 worth of wood. In Australia the wood of the eucalyptus tree is coming to be extensively used for manufacturing purposes, and it is probable that in time new and important uses will be found for the wood in California.

Rock Emery Millstones.

Rock emery is a new phrase in mechanics. It is applied to blocks of emery in their natural condition. It is one of the hardest mineral substances known, except the diamond. Every modern attempt to give regular form to this intractable substance, which no metal tool can cut, has, until recently, failed.

The wonderful success of the emery wheel in the workshop prepared the way for the acceptance of emery millstones in the mill. But great difficulties were at first met with in their manufacture. At last, however, a rock emery millstone has been produced of perfect form, ample strength and suited for every purpose of fine grinding. Hundreds of them are already in use, successfully working on all classes of material. The large emery blocks are set in a metal filling that is nearly as hard and much stronger than cast iron. The face of the millstone is perfect, and so hard that it never needs dressing, and fortunately does not require it, for it is too hard to be cut by any tool. When compared with other millstones, the first point to attract attention is the increased output of the emery stone. The ordinary buhr does daily less grinding, and it soon becomes necessary to take it up for sharpening. The rock emery stone, however, keeps steadily at work, and on all moderately hard grinding, like grain or soft minerals, runs for months, becoming sharper and increasing its output; and when, finally, it requires attention, it is only to deepen its furrows, which are made of a soft rock easily cut out. The emery face should never be disturbed. Rock emery will not glaze, nor is it affected by heat. If the stones get together, no harm is done, nor are rock emery stones damaged by small bits of iron or steel that may get between them.

Rock emery forms, as would be expected, one of the hardest, strongest and most cutting and durable millstones. Rock emery millstones are also but a trifle more expensive than the best French buhrs, which is a point in their favor.

Rock emery millstones not only displace the French buhr, but also the expensive iron mills recently introduced, which cost from three to five times as much as rock emery mills, and do less work and of an inferior quality.

No millstone material can compete with rock emery, for it reduces easily many materials that other millstones cannot grind at all.

Electricity on the New York Canals.

In his recent annual report, referring to the use of electricity on canals, the State Engineer, Mr. Adams, well says:

The many wonderful achievements of recent years in the development of electricity as a motive power inspire the hope that it may soon be made applicable to the propulsion of canal boats at a cost that would render its use practicable and profitable to all concerned. The excessive weight and expense of the best storage battery which science has as yet devised, and which would be sufficiently powerful to meet the needs of this service, seem to exclude such an appliance from serious consideration at this time. Motors placed on the boats and made to operate the common form of screw propellers will not accomplish any appreciable saving of either weight or space over a steam engine and boiler, and in many respects would be decidedly inferior thereto. Such a method would require two trolley wires, for boats bound in opposite directions, and the boats would be helpless when not nearly under these wires. Moreover, the cost of installing such a device in the boats would be practically prohibitive to the majority of the boatmen, the cost being nearly that of steam, while lacking its many advantages above mentioned.

A Novel Rat Poison.

Enormous business has been done lately at French fairs by a man who professed to sell a rat powder that was perfectly harmless, and that struck rats dead on the spot. In order to convince the skeptical, the man first of all powdered a slice of bread with the stuff and ate a piece of it himself. Then he put the remainder under a glass case, in which a rat was kept in captivity. The rat went to eat the bread and instantly fell dead. At five pence a box the powder went off like hot rolls, and the lucky proprietor of the specific was in a fair way to make a fortune. But the police, who in France are very active in protecting the people from fraud, looked into the matter and found that the powder was nothing but ordinary sugar. They also discovered that the case was connected with a powerful electric battery, and that the moment the rat touched the bread the current was turned on, and it was thus his death was brought about. The man was arrested at the fair of Albi.

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A FACTORY CHIMNEY STRUCK BY LIGHTNING.

The sugar manufactory of Kojanka is situated in the government of Kiew (Russia), upon the railway line from Kiew to Odessa.

During the season 1893-94, the sugar works of Kojanka treated 21,887 tons of beets in 54 days, which gives a mean work of 405 tons per 24 hours. The quantity of sugar produced during the season 1893-94 was 5 770,530 pounds, corresponding to an output of 12 pounds of white crystallized sugar to 100 pounds of beets. The boiler house contained 10 steam generators of a total heating surface of 12,300 square feet, and was provided with two chimneys, one of iron plate 5 feet in diameter and 95 feet in height, and one of masonry, of 2½ feet square section and 105 feet in height.

As the draught was inadequate, and as the addition of new boilers was rendered necessary in consequence of the extension of the works, it was decided to construct a single chimney of large dimensions. In the first place, a well was driven in order to ascertain the nature of the ground. At a depth of 8 feet a stratum of water derived from a neighboring pond was reached, and as the subsoil consisting of argillaceous earth did not appear sufficiently solid, piles were driven down in order to strengthen it. Solid earth was found at a depth of 22 feet beneath the bottom of the well.

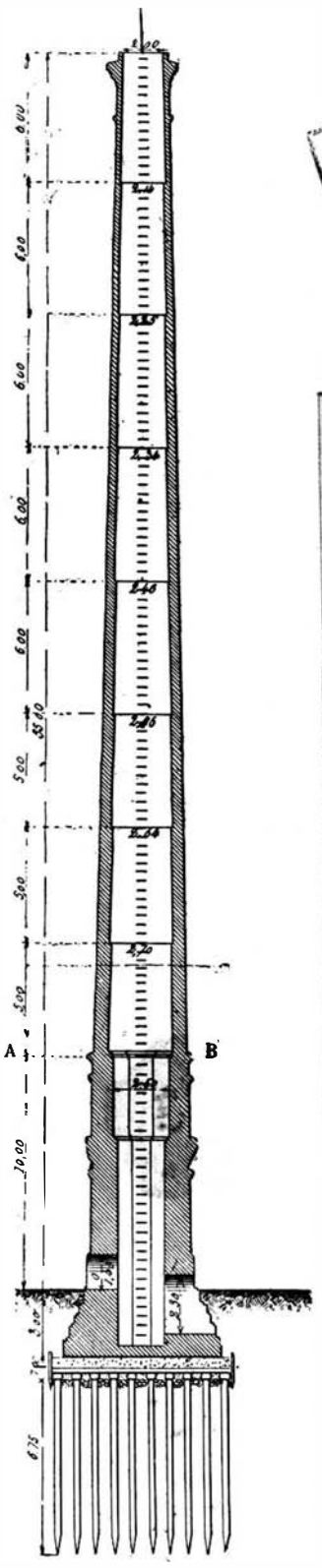

Fig. 2.—VERTICAL SECTION OF THE CHIMNEY.

The chimney, Figs. 1 and 2, rests upon 100 piles from 22 to 25 feet in length, spaced 2½ feet apart and distributed over an area of 640 square feet. The piles are of oak and are not shod with iron at their point. Two pile drivers actuated by horse power and one actuated by manual power were used in driving these piles. The work of excavating the earth and driving the piles was carried on day and night without interruption and lasted 120 hours.

The heads of the piles were connected by a framework of oak, and the whole was covered with a bed of concrete three feet in thickness composed of two parts of cement to three of sand and four of broken granite.

The foundation, which is ten feet in height, and the pedestal, whose height is thirty feet, are constructed of common Kiew brick.

The shaft of the chimney, of a height of 148 feet, is constructed of special perforated bricks from Chemnitz. The thickness of the masonry at the base is 20 inches, which is reduced at the summit to 9.

The total weight of the masonry is 1,870,000 pounds. The load upon the heads of the piles is 160 pounds to the square inch.

The work, which was begun on the 23d of May last, was finished on the 30th of June, and thus lasted but 75 days; but the fate of this structure so rapidly finished was ephemeral. In fact, during the night between the first and second of July, a fearful storm let itself loose over the country, and at half past eleven o'clock a thunderbolt struck the chimney and produced an immense rent about four feet in width and extending throughout its entire length, as shown in Fig. 1. Fragments of bricks, and even whole bricks, were thrown to a distance of eighty yards. No serious accident happened to any one. A night watchman, stunned by the noise, fell to the ground and was picked up unconscious, but free from wounds.

The lightning had followed the vertical line of the iron ladders placed in the interior of the chimney, and which were all torn out and broken or bent. These damages are easily explained by the fact that the chimney had not as yet been provided with a lightning rod.

The repairs, which were at once begun, consumed twenty days, and on the 24th of July the lightning rod, consisting of a 3½×4 inch flat iron, was put in place.

It seems that in order to prevent the possibility of such accidents in the construction of the large chimneys of manufactories, it would perhaps be necessary at the beginning of the work to install upon the summit of the masonry in the course of execution a lightning rod provided with a conductor that could be elongated in measure as the needs of construction demanded.—Le Genie Civil.

Diatoms.

Writing to the Microscopical Journal, Mr. William A. Terry, of Bristol, Conn., says: At low tide at Shell Beach there is a broad expanse of soft mud laid bare below the sands; this mud just before the return of the tide was covered with a brown film that I recognized at once as being composed of living diatoms. On

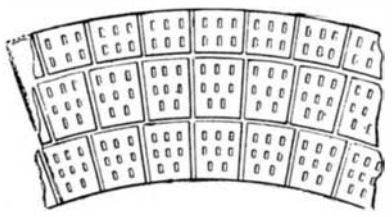

Fig. 3.—HORIZONTAL SECTION THROUGH A B.

examination the microscope showed that these were chiefly three different sizes of naviculoid diatoms aggregated into separate colonies, the smallest form being so minute that a power of 500 diameters was needed to definitely show their outlines; the next size being about double their linear dimensions, and the third considerably larger and showing the crossband of a Stauroneis.

I took a small fragment of the film about 1-10 of an inch in diameter and separated and mixed it with a few drops of salt water; then took one drop of this and placed it on a slip and covered with an inch square cover glass. Under the microscope, this showed the film broken into minute pieces in which the diatoms were packed in solid masses, each kind separately, and were motionless; but thousands of each variety were diffused through the water and these were very active, showing their characteristic motions and their usual color. On counting the diatoms in the field of view in various parts of the slide, I estimated that this drop contained over 250,000 individual diatoms; and as this was less than 1-5 of the fragment of film under examination, I thought it safe to conclude that each square inch of this film contained over one hundred million diatoms. As the area covered by this sheet of living diatoms was about 20 rods in width and some 80 rods long, the number of individuals composing it may well be reckoned inconceivable.

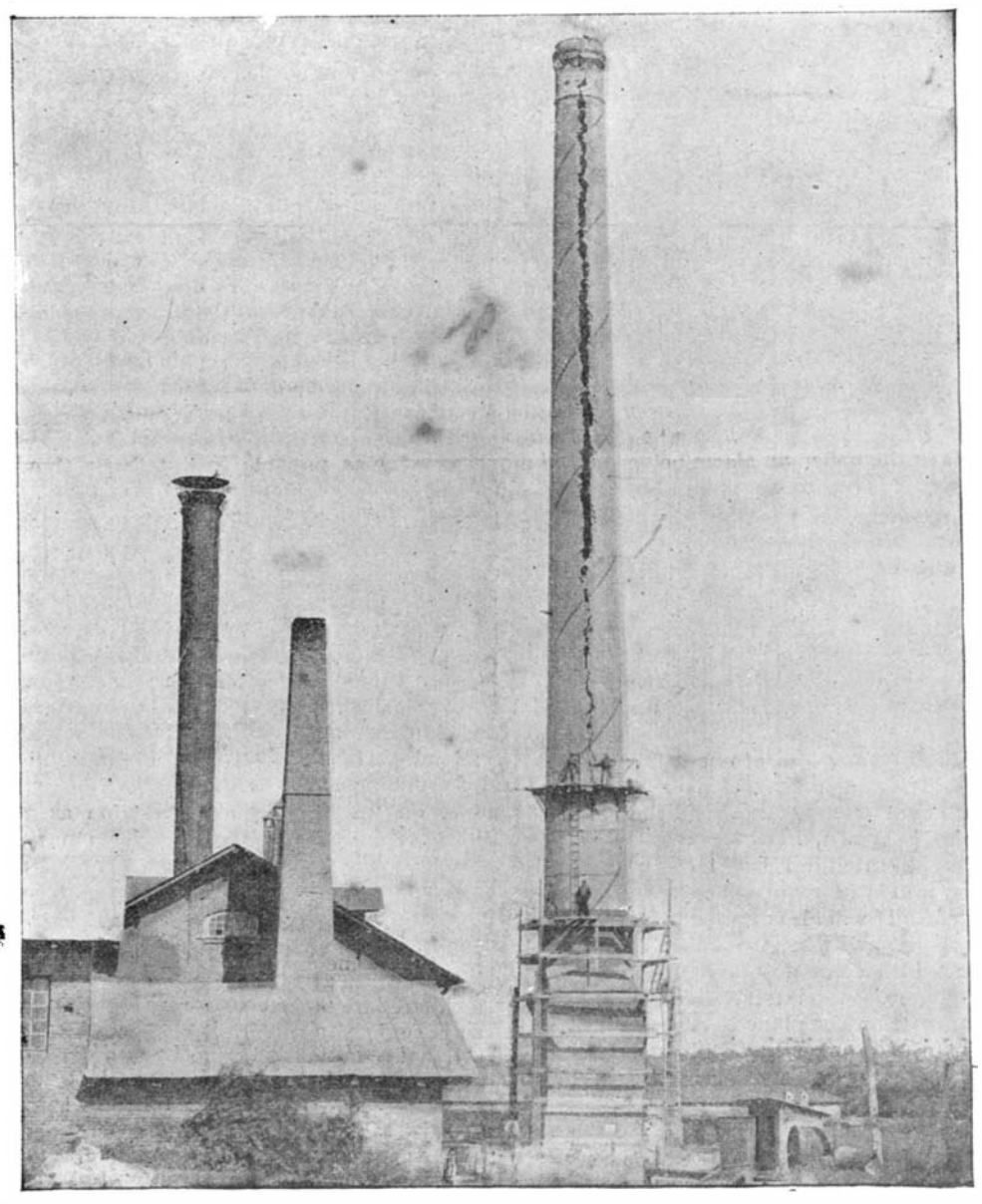

Fig. 1.—CHIMNEY OF THE KOJANKA SUGAR WORKS AFTER BEING STRUCK BY LIGHTNING.

The New Constituent of the Atmosphere.

Thursday, January 31, was an eventful day in the history of the Royal Society, as well as in scientific circles, inasmuch as it was the first occasion on which a meeting of the society had been devoted to the discussion of a single subject in presence of the general public. Moreover, the subject was one to which a good deal of attention has been directed since the meeting of the British Association in Oxford last year, when Lord Rayleigh startled the world by announcing the discovery of a new constituent of the atmosphere. It was to hear his lordship's colleague—Professor Ramsay—read a paper on this subject, communicated to the society by them conjointly, that a large audience assembled in the theater of the University of London on January 31. The new gas is called "argon;" and, so far as is at present known, it stands entirely unrelated to any other substance in nature. We are therefore warned that "every theory of its constitution must be accepted with extreme caution." As to its physical properties, its solubility in water is 2½ times as great as that of nitrogen. Examined by the spectroscope, it shows that it has two distinct spectra, like nitrogen itself; but while the nitrogen spectra are of different characters, those of "argon" are of the same type. According to Professor Olszewski, of Cracow, the critical point of the new gas is —121°; the critical pressure, 50·6 atmospheres; the boiling point, —187°; the melting point, —189·6°; and the density of the liquid, 1·5. The new nitrogen has been aptly characterized as a "strange substance, being as volatile as nitrogen or oxygen, and therefore not capable of separation by difference of boiling point."

Preservation of Wire Ropes and Cables.

A compound which any one can make, of tar, summer oil and mica axle grease, in varying proportions to suit the conditions, is suggested by John A. Roebling's Sons Co. The tar and oil must be free from acid. This combination thoroughly penetrates between the wires, prevents rust, and fills the cable. It sheds water successfully, and does not strip off. Cables which have been treated with this material, when taken apart show every wire bright and clean, the heart or hemp core being also in prime condition.

As soon as a wire rope has been well filled with this compound, the addition of a very little from time to time keeps it in good condition, so that it is economical.

The best manner of applying it is by means of a drip, which pours it on, in a fine stream, while the rope is in use, care being taken to put it on very slowly.

A SPECIAL mouthpiece for public telephones has been introduced in Germany with the object of avoiding the spread of diseases carried by the condensed moisture of the breath. A pad or a large number of disks of paper, with a hole in the middle, is inserted in the mouthpiece, and the upper disk of the paper is torn off after every conversation.—Electricity.

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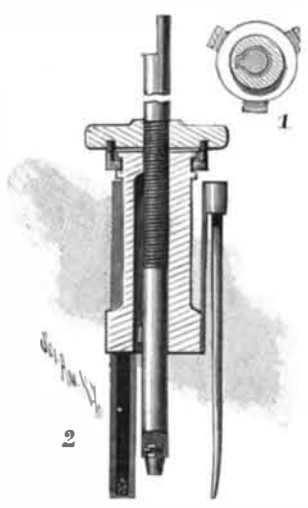
PHILBROOK'S DENTAL TOOL.

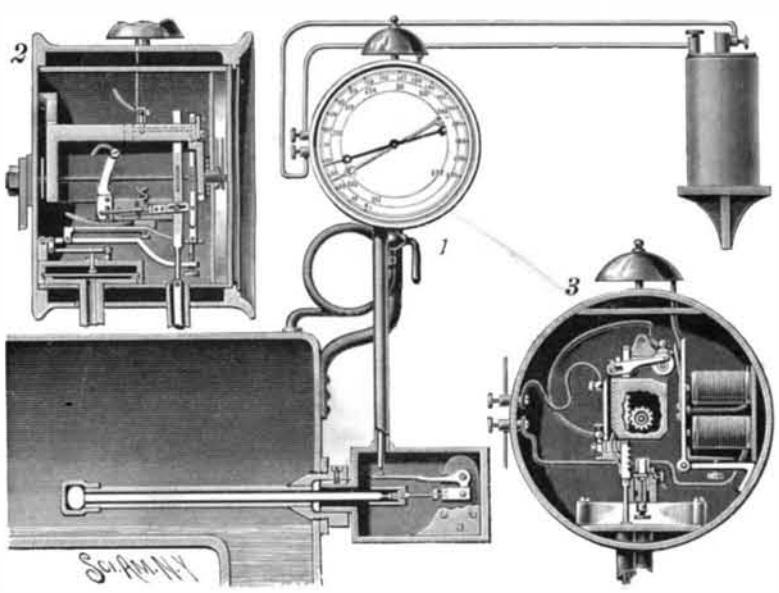
This tool, patented by Dr. B. F. Philbrook, of Dunlap, Iowa, is especially adapted for reducing a root to receive a cap, crown or bridge, and may be used in connection with dental engines, hand pieces and right angled attachments. Fig. 2 is a central longitudinal section and Fig. 1 a plan view through the tool. The mandrel is exteriorly screw-threaded, and has an interchangeable pivoted point adapted to enter the nerve seat of a tooth. A hub or tool carrier sliding loosely on the mandrel has in its inner wall a longitudinal groove receiving a feather on the mandrel, so that the tool carrier is free to slide upon, but revolves with the mandrel. An annular groove at the upper end of the tool carrier receives fixed pawls fast to a threaded milled nut, by rotating which the carrier is moved up or down on the mandrel. Two, three or four springs, secured at one end to the lower end of the tool carrier, have at their other ends each a socket to receive the shank of a cutting tool extending in the direction of the operative end of the mandrel. These tools are adapted to engage the peripheral surface of the root at the top, are preferably made of copper or aluminum, and have diamonds or diamond dust in their inner surface at their working ends. The tools are also longitudinally grooved to hold corundum or emery, and in operation, as they are rotated, the springs constantly hold them in engagement with the periphery of the root, which is thus reduced without changing its contour. The tool holder being adjustable upon the mandrel and controlled by the milled nut, the cut can be increased or lessened at will, one size hub or tool carrier being well adapted to reduce any of the human teeth or roots for crown or bridge work.



A GAGE INDICATING PRESSURE AND TEMPERATURE.

Both pointers of this gage are designed to move in unison as long as the boiler is working under normal conditions, the heat indicator hand traveling faster than the pressure gage hand when an abnormal increase of heat takes place in the boiler, an alarm being at the same time sounded. The improvement has been patented by Mr. Albert F. Mallick, Jamestown, North Dakota. Fig. 1 is a side elevation of the improvement as applied and Figs. 2 and 3 are sectional views of the gage. Extending into the boiler just above the crown sheet is a pipe on whose inner end is a cap forming a socket for the head of a rod extending loosely through the pipe and into an outer casing. The rod is preferably of glass or of any material that expands and contracts less than the pipe. The outer end of the rod is pivotally connected with the short arm of a bell crank lever, on the free end of the long arm of which rests a vertical rod connected with the indicator casing. The upper end of the rod is connected by a rack and pinion with a shaft which moves a pointer on the face of the dial, the expansion and contraction of the pipe within the boiler communicating a corresponding movement to its inclosed horizontal rod, and through the bell crank lever to the vertical rod connected with the indicator, and thus indicating the changes of temperature in the boiler.

On the same dial is also indicated the pressure of steam in the boiler, a pipe from the steam space connecting with a diaphragm which is also connected by adjustable levers with a rack in which meshes a pinion on the shaft which carries the pointer. But when the temperature in the boiler becomes abnormal, a swinging motion is imparted to a lever pivoted on one of the racks, whereby a battery is brought into circuit with a magnet within the casing to actuate an armature lever and sound a bell. The alarm is sounded when the steam pressure is reduced and heat is not withdrawn from the water, or when the temperature is increased and steam pressure remains the same, abnormal conditions of the boiler being at once indicated, so that the attendant may apply the proper remedy to avoid or prevent an explosion.



MALLICK'S BOILER ALARM GAGE.

How to Repel Train Robbers.

"How to Repel Train Robbers" is the title of a short paper in the North American Review for February by Lieut. John T. Knight, of the United States Army. His principal suggestion is that the express car should be placed at the rear end of the train, so as to compel the attacking party to divide its forces. The express messenger should be able to communicate instantly to the cars by electric alarm bell or other effective means, and the passengers should be able to get repeating shotguns from a glass-front case in each car. Thus a messenger could give warning as soon as any one approached his door at an unusual time or locality, and the passengers and trainmen, being between the robbers attacking the engine and those attacking the express car, would have a decided advantage. Moreover, it would be necessary, in order to cover the engine, the express car and a sufficient number of points between, to employ so large a force of men that the probable profits per man would not be large; and this would discourage the industry. Mr. Knight has been in the cavalry service in Oklahoma Territory; in sending a guard to protect a paymaster he always ordered it to keep 100 to 150 yards behind the wagon carrying the money, so as to compel the attacking party to divide its forces.

The lieutenant's suggestion seems sensible. If we are going to fight train robbers, the advice of expert fighters is worth attention. But, as we have heretofore said when discussing this subject, the only rational remedy is to civilize our country. Repulsing or punishing the robbers is not a satisfactory remedy, certainly not satisfactory to passengers, most of whom, in any train, even in the Wild West, come under the appellation "tenderfoot." To deter would-be robbers from getting together is the desideratum. That is the main element in the success of the police in large cities in repressing violence; they keep suspicious characters on the move as much as possible, so as to have them out in sight and let them know that they are being watched. Indeed, Lieutenant Knight evidently regards the idea of making robberies unprofitable (by forcing the robbers to see that they will have to have a large force of men in order to accomplish their object) as his most valuable suggestion. This will deter them, if anything will, for their sole object is money, says the Railroad Gazette.

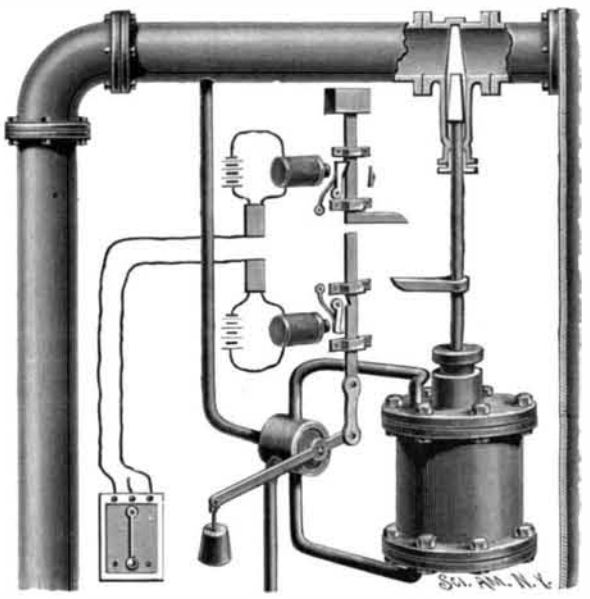
Economy in Cotton Transportation.

It was noted in our columns, says the Manufacturers' Gazette, a month or more ago, that an experiment was to be tried of fetching from Galveston a large lot of cotton by steamer, with a barge in tow. This has been successfully accomplished, and the cotton landed in good condition at one of the Boston wharves. It was an undertaking of more or less concern to marine insurers, and of some interest to those in the cotton trade, because of its originality and the doubt surrounding its success. The barge was a four-masted schooner, and was capable of taking care of itself had it broken loose from the steamer by the parting of the hawser. The latter was nine inches in circumference and was payed out 1,500 feet. At no time was it brought taut, because of its great weight and length. The steamer and barge carried together 7,059 bales, the former 2,962 bales and latter 4,097 bales. The consignees state that there was a saving on the shipment in freight over ordinary ocean transportation of $6,500. What there is in the future for this method of shipping cotton to New England ports we do not venture to say, but it is suggestive of what may be done in lowering the cost of freight from Southwestern points to a figure that will do away with Southern advantages in this particular that now exist.

With favorable freight rates for New England mills, long-stapled cotton from the Mississippi bottom lands and from the Southwest, such as is required for fine counts of yarn, can be landed at these mills as cheaply as at the mills in the Piedmont district. For fine yarns, cotton can or may be soon delivered to Northern mills as cheaply as to the mills of the South Atlantic States. If the mills of South Carolina, for instance, attempt to go into fine yarns, they will have to go outside of their own vicinity for any considerable quantity of the cotton that they may require.

ELECTRICALLY CONTROLLED VALVE GEAR FOR PUMPING STATIONS.

The improvement represented by the illustration is more especially designed for use in controlling supply pipes connecting a pumping station with a distant stand pipe, to enable the engineer at the station to open or close the supply pipe, connecting it with or disconnecting it from the stand pipe. A patent has been granted Mr. William Engberg, of St. Joseph, Mich., for the invention. The gate valve in the supply pipe is on the upper end of a piston rod passing through suitable stuffing boxes to a piston head in a cylinder connected by pipes at its upper and lower ends with the casing of a valve in which is a hollow valve plug, and the latter is connected by a small pipe with the supply pipe, so that water under pressure may pass to the valve plug. In this valve are opposite ports, adapted to alternately register with the pipes from the top and bottom of the cylinder, a channel also connecting with a discharge pipe. A lever carried by the stem of the valve plug supports at one end a weight and is connected at its opposite end by a link with a bar sliding in suitably arranged bearings, a notch in the bar being adapted for engagement by a spring-pressed armature operating in conjunction with an electro-magnet connected through a relay with a switch at the distant pumping station, under control of the engineer in charge. In vertical alignment with the sliding bar is another sliding bar, its upper end carrying a weight, its lower end having a foot adapted to engage an arm on the piston rod, and having in one side a notch adapted to be engaged by the spring-pressed armature of another magnet, also connected through a relay with the switch, the movement of the switch lever closing the circuit for either relay, and causing the corresponding magnet to attract its armature. As represented, the gate valve is open and the piston in its lowermost position. To close the valve, on the movement of the switch lever, the upper magnet attracts the armature lever and thus unlocks the upper sliding bar, which is moved down by the weight at its top and strikes the upper end of the lower bar, moving the latter downward and turning the valve plug to supply water under pressure to the lower end of the cylinder, and open the channel connecting its upper end with the discharge pipe. The piston consequently moves upward and closes the gate valve, the arm on the piston rod at the same time engaging the foot of the upper bar and elevating it, where it is held in locked position on the breaking of the circuit, and the releasing of the armature lever, which then engages the notch, the other bar being also locked in its lower position by the other armature lever. The operator always turns the switch lever to normal position after the circuit is temporarily closed.



ENGBERG'S VALVE GEAR.

A New Russian War Ship.

The Fremdenblatt gives the following particulars of the new Russian ironclad Georgi Pobiedonostzeff. This great war ship, the construction of which was begun on August 12, 1889, has steel armor from 8 inches to 16 inches thick on the sides, while the casements are protected by 12 inches and the traverses by 9 inch to 10 inch plates. The total length of the ship, including the ram, is about 340 feet. The vessel is 69 feet broad and 26 feet 7 inches deep, with a displacement of 10,280 tons. It is supplied with two engines constructed in England, which will develop 10,600 horse power under ordinary pressure and 16,000 horse power under forced draught. The new man-of-war is armed with six 12 inch and seven 6 inch guns, as well as 14 quick-firing guns of English manufacture.

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Hard Rubber Casting Patterns.

BY JOHN T. USHER.

India rubber has been employed by the writer with very satisfactory results for making small patterns. Such patterns can be made and finished more cheaply than those made of metal and in many cases more cheaply than those made of wood. Patterns made of rubber are especially adapted to card pattern work, which consists of a number of patterns grouped together and attached to a metal plate, or upon a wooden board, together with the gate and spun channel pattern, the iron moulder being enabled thereby to produce at one operation a mould complete, ready for pouring in the metal. The rubber patterns are also eminently adapted for use in connection with a follower board, for grouping generally or to be used singly. The advantages claimed for rubber patterns are: 1. Their extreme lightness; (2) durability; (3) strength; (4) freedom from shrinkage and warpage; (5) freedom from the attacks of water or acids, heat or cold under ordinary conditions.

It is presumed that all the readers of the India Rubber World are acquainted with the manipulation of rubber in a general way. Therefore only a summary of the methods employed in making the preliminary patterns and moulds from and in which the subsequent patterns are produced will be given.

The preliminary patterns can be made of wood, beeswax, modeling clay, or modeling composition; in fact, of any substance which can be shaped to the desired form and which will retain this form long enough to allow an impression to be taken in plaster of Paris. In many cases the preliminary pattern can be formed all the more easily by making a face pattern of either of its sides. Then pour an impression of the face pattern and form the preliminary pattern therein or thereon with beeswax, and then pouring or making a plaster mould on or of that as the case may be, the face pattern or mould upon or in which the preliminary pattern is formed serving as one-half of the mould. The other half mould being made by pouring or making a counter impression directly on or in the first impression of half mould, cutting rings, grooves, or depressions some distances from the mould surfaces proper to locate the two halves of the mould in their respective positions.

The moulds can also be made in plates or metal without any preliminary pattern in the usual manner, if preferred. When the plaster moulds are to be used to make patterns in, they must, after being made, be invested in a metal flask. After the first pattern has been made, it may be used as a pattern for making all the subsequent plaster moulds needed. When a preliminary pattern has been made or is available, the plaster moulds should always be made directly in the flasks, thereby avoiding the necessity of inverting the moulds after they have been made.

To pour an impression, and in making moulds of plaster in order to get the best results, the article to be poured should be first shellacked and allowed to dry, and then soaked in water for ten minutes or more, and then poured while it is still wet. If the article to be poured is made of some other material than plaster, it may be dipped in water and then poured while still wet, but on no account must oil or any greasy substance be used to insure an easy separation if the latter are to be used for making the patterns in.

In pouring an impression, the amount of water necessary to saturate the plaster is first poured into a soft rubber bowl, a pinch of common table salt is then added and stirred in, the plaster is then added by shaking it out of a scoop in order to loosen it as much as possible, then let it stand a few seconds until thoroughly saturated; the surplus water can then be poured off, and the plaster stirred or mixed. If this has been done properly, the mixture will then be of the consistency of thick cream. When salt has been added the plaster must be used immediately, as it commences to set very quickly. In no case must the plaster be put into the bowl before the water, as it will nearly always come out lumpy after being mixed, and it is also liable to crumble away during the process of vulcanizing. In pouring an impression, a little of the plaster is first poured on the highest part and is then made to flow to and around the lower parts as quickly as possible by taking the article in the hand or hands and jarring it sharply; a little more plaster is then added again on the highest part and the jarring repeated, and so on until enough has been added. Should the jarring be omitted when pouring, or too much plaster be added at one time, the chances are that the work will be imperfect.

Should the shape of the moulded article be such that the parts cannot be separated by inserting the point of a knife blade between them, without the risk of breaking, then the part that has been poured must be carefully cut away until the shell and surface can be seen through the plaster. This cutting can in most cases be done in such manner that the parts can be lifted away in large pieces, leaving the part it is desired to save intact.

In making hard rubber patterns, where the body of the pattern or any part of it would be more than ¼ inch in thickness, it will be necessary to so arrange the moulds as to produce a shell pattern.

When cores are used, the plaster of which they are made must be mixed with carbonate of lime, as whiting, chalk, or marble dust, in such proportions as to allow of its being readily dissolved in acid after the patterns have been vulcanized. This removes the cores, the plaster of Paris being in itself insoluble. A mixture of half plaster and half whiting will be found to be very satisfactory for making the cores.

If the patterns are immersed in muriatic or sulphuric acid, the whiting will dissolve very quickly, leaving the plaster as a precipitate, which can be easily washed out with water, without in any way injuring the pattern. Paper also makes an excellent core for this purpose; in fact, better than plaster. When metal moulds are desired in preference to those of plaster, it will be found easier and better to first make the plaster moulds, and then, after carefully shellacking them, to use them as patterns from which to cast the metal moulds.

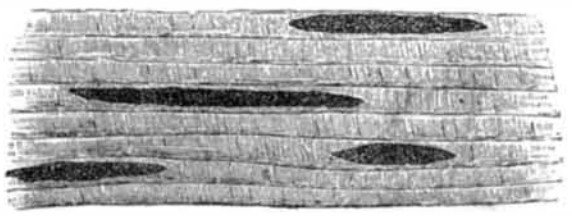
Before packing the plaster moulds, the surfaces proper should be coated with collodion. After being packed, they should be put into boiling water for a few minutes to soften the rubber prior to closing the moulds. The pattern may then be vulcanized. After vulcanization they must not be taken out of the moulds until thoroughly cold, otherwise they are liable to warp.—India Rubber World.

A PARASITE VERY NUMEROUS IN HOGS.

BY PROF. JOHN MICHELS, LATE U. S. DEPARTMENT OF AGRICULTURE.

During the four years in which I had charge of the inspection of hogs for the United States government, my attention was drawn to a parasite which was so numerous that it was found almost daily during the search for Trichina spiralis under the microscope.

This parasite, shown in the cut which accompanies this article, has the appearance of an elongated worm with a blunt point at each end. It assumes many forms, sometimes being narrower and longer than shown in the drawing and at other times broader and shorter, and even almost round. The interior is com-



posed of granular matter, which with a high power proves to be embyros, the worm-like body being only a sac.

These sacs are sometimes very numerous in the muscle, while each sac contains many hundreds of the embyros; taken together the number existing in some hogs must be counted by the million.

This parasite, which is considered to be harmless, is called by the United States Department of Agriculture "Tarcosperidium," and by the Germans "Psorospermien," and it is remarkable, considering their great number in a food product, that little appears to be known of their life history.

I have made preparations of the sac for microscopical examination, and expelled the embryos from the sac, which prove to be the shape of half moons.

Rapid Fire Guns.

One of the most important lessons of the naval battle of the Yalu River was the demonstration of the great importance of the rapid firing guns, especially when the ships to which they are opposed are not protected. The recent trials at Indian Head will probably lead to the adoption of rapid fire mechanism hereafter for our 6 inch guns. Two 6 inch breech-loading rifles fitted as rapid fire guns have been tried. One was fitted with a Dashiell breech mechanism, and the other with Lieut. F. F. Fletcher's new breech mechanism. The record claimed for the Fletcher gun is said to be five rounds in 54 seconds. This invention is a close competitor of the Armstrong gun of the same caliber, six rounds in one minute being fired from a gun of that make a short time ago. The Krupp gun of 15 centimeters, which is equivalent to 5·87 inches caliber, was fired at the Meppen ground at the rate of eight aimed shots per minute, and eight shots were fired at a target 3,000 meters away in 40 seconds. On the British Royal Sovereign a series of ten aimed rounds were fired from an Elswick gun in 1 minute 57·8 seconds. The French rapid fire Canet guns 5·91 inches caliber have been equally successful. In England an 8 inch Armstrong gun has been tested which gave very remarkable results. The interval between the shots for an ordinary 8 inch piece is about 1 minute 15 seconds; the new Armstrong gun fired shots at an interval 15 seconds with a crew of only five men.

The mount for a rapid fire gun is hardly second in importance to the gun itself, as quick loading and firing would be of very little value without special facilities for training, elevating and sighting; mounts are now receiving great attention both at home and abroad.

Water.

Pure water consists of 2 parts hydrogen and 1 part oxygen. Chemical name hydrogen oxide, chemical symbol H_2O. Pure water is a colorless, odorless, tasteless, transparent liquid, and is practically incompressible. Water freezes at 32° F. and boils at 212° F. At its maximum density—39·1° F.—it is the standard for specific gravities, and 1 cubic centimeter weighs 1 gramme.

1 United States gallon... =	231 cubic inches. 0·13369 cubic foot. 8·3311 pounds—distilled water. 8·34 pounds—in ordinary practice.
1 cubic foot.... ..... =	62·425 pounds at 39·1° F., maximum density. 62·418 pounds at 32° F., freezing point. 62·355 pounds at 62° F., standard temperature. 59·64 pounds at 212° F., boiling point. 57·5 pounds at ice.
1 cubic foot..... ...=	7·485 U. S. gallons.
1 pound .....=	27·7 cubic inches.
1 cubic inch.....=	0·03612 pound.

A column of water 1 inch square and 2·31 feet high weighs 1 pound.

A column of water 1 inch square and 1 foot high weighs 0·433 pound.

A column of water 33·947 feet high equals the pressure of the atmosphere at the sea level.

One pound per square inch equals a column of water 2·31 feet in height.

0·433 pound per square inch equals a column of water 1 foot in height.

Water is an almost universal solvent; consequently pure water does not occur in nature. Sea water contains nearly every known substance in solution.

The latent heat of water is 79 thermal units. When water freezes, it gives off its latent heat. The latent heat of steam is 536 thermal units. When steam condenses into water, it gives off its latent heat.—Catalogue of Holly Manufacturing Company.

The Iowa Meteorite.

The Boston Commonwealth says: A close examination of the fragments of the Winnebago County (Iowa) meteorite has been made by Prof. H. A. Newton, of Yale College. More than a thousand pieces of the meteor are in the museum at Yale, and the examination of them results in some interesting deductions. The meteor was a very noticeable one and attracted the attention of very many persons over a large extent of country, from the comparison of whose stories the details of the meteor's approach have been determined. One man, a surveyor, had the presence of mind to direct his theodolite to the cloud left after the explosion, and an accurate reading of his circles gave most reliable data. The fragments were scattered over several square miles, and vary in size from a grain of dust, almost, to some eighty pounds. It is estimated that the meteor must have been at least five hundred pounds in weight and was perhaps as large as a small flour barrel; and that it approached the earth with planetary velocity, or about ten miles per second, in an orbit not unlike that of the earth itself until within about five miles, when it burst. After the explosion, the velocity of the pieces could not have been greater than that of sound, or about a quarter of a mile per second. After the primary explosion, there must have been numerous minor ones, evidence of which is to be seen in the fragments themselves. Their velocity was so great that the friction of the surfaces against the air caused the material to fuse and to flow backward over the edges. Different stages of fusion are clearly noticeable, and in addition many cases of fresh fracture, which must have taken place when the fragment was quite close to the earth.

How to Arrest a Boil, Carbuncle, or Malignant Pustule.

Dr. Barker writes to the Medical Summary that he has used the following procedure for several years with unvarying success: Take a large hypodermic syringe, holding say half an ounce, fitted with a small needle. Fill it with a 1 to 500 solution of mercuric chloride, insert the needle into one of the peripheral openings, in case it is a carbuncle, and wash out the little cavity. Then direct the needle toward and into the surrounding induration and force a little of the solution into it. Treat each opening and its corresponding peripheral circumference in the same manner, carefully washing out the necrosed connective and other tissues that have become separated. Repeat this daily with the solution, gradually reduced to one-half the original strength, until all induration has disappeared and granulations have begun to appear. If the first injection be thoroughly performed, the spread of the carbuncle will be arrested at once and there will be no more pain. Washing out the little cavities is painless, but the injection into the indurated tissues is not free from pain. The same treatment is applicable to the little feruncles that invade the meatus auditorius externus and the inner surface of the alæ nasi.—Medical and Surgical Reporter.

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THE TEACHERS' COLLEGE OF NEW YORK CITY.

Nearly twelve years have passed since the Teachers' College was organized under the name of the Industrial Education Association. After passing through its successive stages of growth and of organization of work, it received in 1892 a charter under its present name. The president of the board of trustees is Mr. Spencer Trask. It is allied with Columbia College and Barnard College in its work, and its building is situated immediately north of the site of the new Columbia College. While it would be interesting to trace its growth in its old quarters, in University Place, from the days when it appeared rather a struggling affair to the present time, when it occupies a new building constructed for it, of admirable features and fitted with the best possible appliances, the present article will be confined to the college as it now is. It is a unique institution; one devoted to the theoretical and practical training of teachers and which, for the latter element, has instituted the Horace Mann School, where practical lessons are given in the art of teaching, and observations of methods as actually carried out are made.

The building is situated on Morningside Heights, in this city, near the tomb of Grant. It has a frontage of 210 feet on 120th Street, and the excellence of its design, due to Mr. Wm. A. Potter, well known architect of this city, is testified to by the views which we produce.

The ultimate cost of building and equipments is put at $900,000.

There are two distinct departments in the college. The Horace Mann School, the first of these, is a complete school in which children are taught. Beginning with the Kindergarten, open to children of three years old, the succession of classes leads through the high school to and through classes in manual culture, drawing and the like until the graduate is prepared to enter college or business life. The Horace Mann School represents the most complete possible primary and high school course, and is carried on precisely as any first-class institution of the kind is conducted, with, however, the benefit of all refinements in pedagogy naturally developed by its connection with the Teachers' College.

In our illustrations of the college, it will be noticed that many of the rooms are occupied by children and grown people. The children are the students of the Horace Mann School, the others are either their teachers or are students in the Teachers' College.

The Teachers' College proper, from which the whole institution derives its name, is an institution for the training in pedagogy of teachers. Its processes include several methods. Lectures on pedagogical subjects, using the term in its widest scope, are given by the members of the faculty. The students are not simply taught chemistry or physics, but study the most advanced methods of teaching these sciences in the school room. Psychology, the history of education, the natural sciences in general from the aspect of the teacher, are other typical subjects lectured on. Laboratory practice is another of the methods. In botany, zoology, geology, chemistry and physics, laboratory work, showing how school work in these subjects is objectively conducted, may serve as examples of the laboratory feature of instruction. So far all is theoretical, at least no experiments on children have been made. It is here that the Horace Mann School comes in. This school is maintained in the highest stage of excellence, and supplies at once a model for the future work of teacher graduates, giving them a school of observation where they can see advanced teaching methods, and a school of practice where they can apply what they have learned.

Such, in as few words as possible, describes the characteristics of the Teachers' College, an institution practically unique in teaching the theory and practice of teaching, using a model school for a laboratory.

Our illustrations give views of the work. The Kindergarten in one cut is seen in active operation, its children representing the youngest pupils in the Horace Mann School. A special course for students of kindergartning is maintained, and under the auspices suggested by our cut the best possible opportunity for becoming efficient in this most difficult of the advanced educational methods is afforded. Miss Angeline Brooks has charge of the entire Kindergarten department. Another cut shows the physical laboratory, where normal work in physics is carried on by the students for the profession of teacher, as well as by the more advanced scholars of the Horace Mann School. Professor John F. Woodhull has charge of this and allied departments, and in carrying out its methods inculcates the use of simple apparatus, the personal construction of apparatus, and general simplification of appliances—ideas which he also carries out in the chemical laboratory.

Next to the physical laboratory is shown the geological laboratory, devoted at present to geology, botany and other branches of natural science. In our cut the Horace Mann scholars are shown at work on specimens, while students of the Teachers' College are making notes on the operations, so that this cut is in some sense an epitome of the characteristic methods of the institution. The art studio speaks for itself, and shows students working in drawing and painting, one of the fundamental theories underlying the college being that every one should know how to draw. The chemical laboratory comes next, where are seen the Horace Mann students doing practical work in chemistry, while interspersed among them, either assisting, teaching or observing, are seen students of the Teachers' College, this laboratory, like the geological, furnishing a good example of the methods. The two next cuts illustrate two of the workshops of the Horace Mann School, where students in the high school department are instructed in manual training. Of these laboratories, which are very complete, we only show two; they give an unexcelled opportunity for teachers to learn the pedagogics of manual training, a subject now in the greatest possible demand. It will be noticed that the instruction in manual training is given to boys as well as to girls.

When it is realized that our illustrations give but an incomplete representation of the work of the institution, it will be seen that New York has in the Teachers' College something to be very proud of, and something which is destined to have a deep influence upon the instructor's art in America. Its faculty, headed by Walter Lowerie Hervery, Ph.D., the president, includes sixteen members, whose work is supplemented by twenty-two assistant instructors. Its work is divided into twelve different departments including seventy-five separate courses, the principal ones of which contain one or more courses counting toward the college degrees of A.B., A.M., and Ph.D.

We have said but little of the departments of Domestic Economy and Physical Training or of the general subjects of the classics, mathematics, "rhetoricals," etc., but all are included and receive, with the assistance of the Horace Mann School, the same thorough treatment which is accorded to other branches. The Bryson Library, founded by Mrs. Peter Bryson, in memory of her husband, is one of the most valuable departments, containing some 5,000 volumes, in a room which may be termed the ideal one for its purpose.

An Invention Needed.

Dr. Peter T. Austen, Professor of Chemistry in the Brooklyn Polytechnic Institute, who is the chairman of the advisory committee recently appointed by Mayor Schieren, of Brooklyn, to consider ways and means to avoid accidents by the trolley system, in speaking to a representative of the SCIENTIFIC AMERICAN, stated that while there was no lack of fender devices, there appeared to be a dearth of devices for announcing the speed of the cars. Probably some device will be required that shall announce by ringing a bell, lighting an electric light, or any other way, when the speed of the car is exceeding the legal rate.

Some sort of indicator, in the form of a dial or some legible device, might also be placed in the car, if not too expensive, so that the passengers might know at all times the speed. A device has been suggested for shutting off the current automatically when a certain speed is reached, but this is impractical, as in case of a failure of the brake on a down grade the inability to reverse the motor might be attended by accident. Prof. Austen considers a speed limit announcing device as a first necessity in controlling the trolley system.

Remarkable Armor Test.

An interesting test of the armor plates for the turrets of the battle ships Massachusetts and Indiana has been made recently at the proving ground of the Bethlehem Iron Company at Redington. The plate tested was of Harveyized nickel steel 15 inches thick, and represented nearly 500 tons of armor. The tests were made with a 10 inch gun, and consisted in firing two shots at the armor from a distance of 250 feet. One shot was to try to crack the plate and the other to pierce it. The curved armor plate was set up on edge and bolted to an oak backing 3 feet thick. This backing was in turn braced against a lot of heavy timbers, filled in with sand and extending back for a distance of 25 feet. Back of this was a mass of trap rock against which the whole target rested. It required several days to prepare the target for the test. In the first test a 10 inch Carpenter projectile of chrome steel was employed, and enough powder was used to send the projectile at the plate with a velocity of 1,539 feet per second. The plate was required to stand this severe test without any serious cracking. The projectile entered the plate for a distance of only about two inches, and was completely shattered, but failed to produce a single crack on the plate itself.

In the second test, a projectile weighing 500 pounds was fired at the same plate at a speed of 1,940 feet per second. The armor, however, offered such resistance that the projectile entered the steel for a distance of but six inches. The shocks were so severe as to completely wreck the timber bracing back of the armor. The naval experts who watched the experiment declared it one of the most successful armor tests ever made.

Punching of Iron and Steel.

In an article in La Revue Technique, M. Ch. Fremont endeavors to show that Henri Tresca gave an erroneous explanation of the phenomenon of punching iron and steel. Most of Tresca's experiments were made on lead. M. Fremont has conducted a number of experiments on iron plates, punching holes in the plate to different depths and then splitting the plate and etching the section with acid, so as to make evident the distortion of the fibers arising during the process of punching a hole. M. Fremont holds that his results show that the metal really yields by traction, being thinned out at the surface under strain and finally giving away. To determine the work required to punch a hole through a plate, M. Fremont has used a simple form of autographic apparatus, recording the motion of the punch and pressure exerted at all parts of the stroke. The principal result obtained is that the maximum pressure required is proportional to the area sheared, and that for the same area cut through a punching machine requires to exert a pressure nearly fifty per cent greater than a shearing machine.

Boiler Explosions.

A paper on boiler explosions, read recently at the Institution of Civil Engineers, by Mr. William H. Fowler, presents, says Nature, some points of interest. The theories, such as "deferred ebullition," "disassociation of water," "spheroidal condition," which have been propounded to account for such explosions, are well known. Mr. Fowler showed that it was the hot water, rather than the steam, in the boiler which formed the source of destructive energy. In regard to the causes of boiler explosions, there is nothing occult or mysterious. They can, as a rule, be traced by patient investigation to the operation of simple and well known facts. Thus when a boiler shell is normally in a state of high tension, if once a rupture takes place by the action of static stresses on a locally weak spot, the stored-up energy is capable not only of tearing the boiler to pieces, but of producing all the other destructive effects observed in connection with such disasters. Prominent among the principal causes of explosions is the corrosion of the boiler shell. Some explosions have their origin in the stresses arising from expansion and contraction due to the action of the fire. As an illustration of the stresses set up by unequal expansion and contraction in a boiler, a case was mentioned in which an explosion occurred two hours after the fires were drawn. A frequent source of boiler explosions in the past is the practice of cutting large openings in boiler shells, without providing compensating strengthening rings. Overheating from shortness of water is a common cause of boiler explosions, but the operation of this cause is different from the reason formerly assigned to it. Explosions are not the result of turning cold water on to red hot plates. What takes place is that the overheated plates become gradually softened, with the result that they bulge downward and are rent at the ordinary working pressure; explosions of this kind are of a relatively mild character. Many explosions arise from excessive pressure in consequence of the defective action of the safety valve. This may occur in a variety of ways, but the type of valve loaded with a spring balance is the most prolific source. Finally, explosions sometimes arise from faulty material and construction. As a result of using iron of poor quality with punched holes, incipient flaws are occasionally set up in the seams, and several cases have occurred in which these inherent defects were so situated as to forbid detection when the boiler was put together, and were only revealed by the explosion. These defects show the value in connection with new work of a careful hydraulic test.

Explosions.

This was the subject of a recent address at Firth College, Sheffield, by Mr. L. T. O'Shea. In the course of his remarks he said that in 1881 Berthelot established the fact that the velocity of explosions in gases increased rapidly from the point of ignition until a maximum was reached, which remained constant, no matter how long the column of the gases might be. This maximum velocity was exceedingly great, and to it Berthelot gave the name of "the explosive wave." Dixon confirmed Berthelot's results, and considerably extended his works. In 1881 Mallard and Le Chatelier showed that before the explosive wave was set up, the flame traveled for a certain distance, depending upon the dimensions of the gallery, with uniform velocity; then it assumed a vibratory motion, and finally detonated with extreme velocity, or died out. What happened in a colliery explosion was that the flame traveled for perhaps 50 or 60 yards with uniform velocity, and in this distance comparatively little damage was done. Then it assumed a vibratory motion, when large masses of heated gases swung backward and forward with increasing amplitude, gathering impetus as they went, and smashing everything before them. From that point the amount of damage done would be greater or less as the vibrations gathered force or died away.

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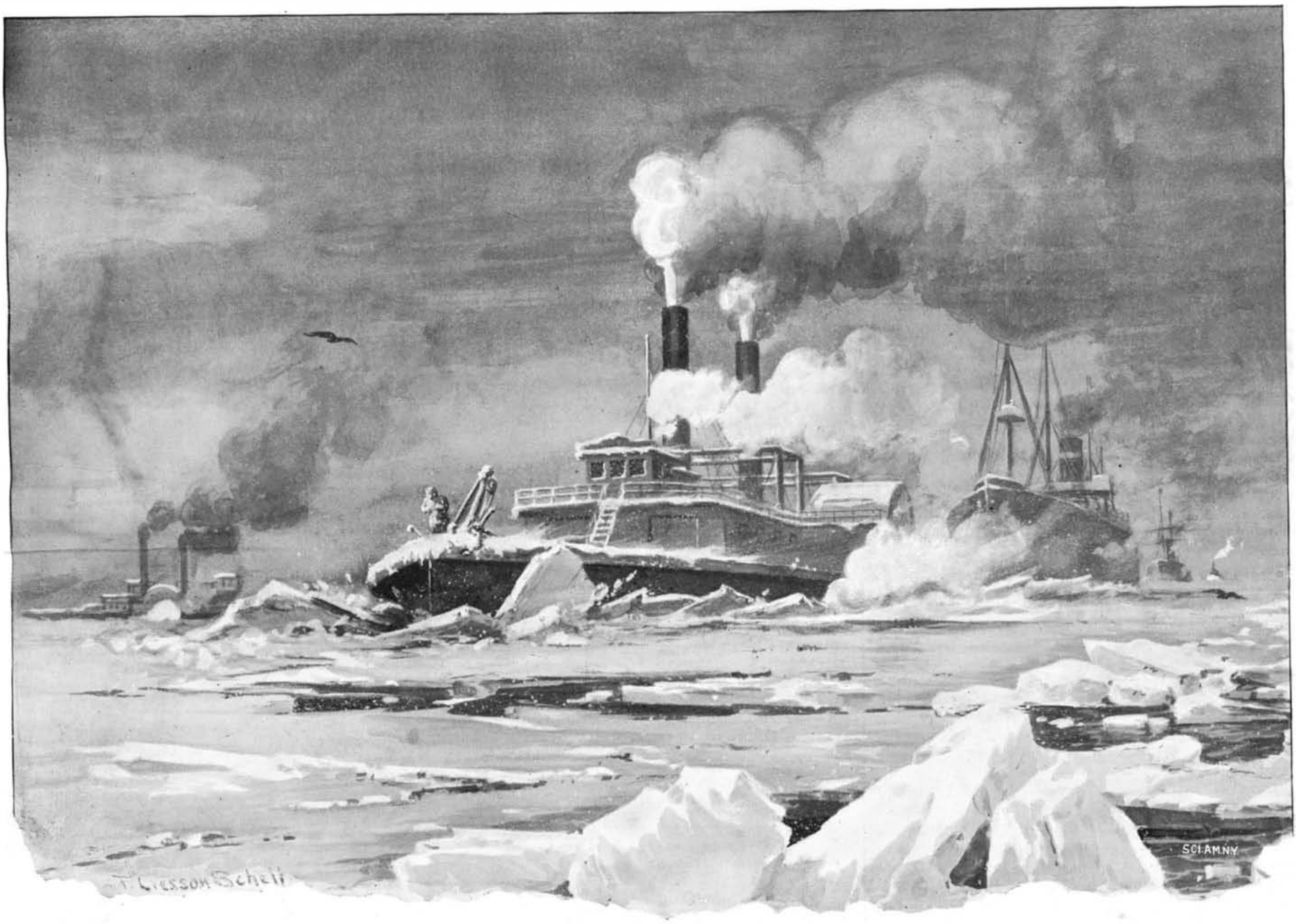
PHILADELPHIA ICE BOATS.

Some years since the city of Philadelphia built three boats specially designed for the work of breaking up the ice in the Delaware in front of and below the city, the river often freezing up in winters of no very great severity, so as to seriously interfere with navigation. Our picture represents the largest and most powerful of these boats at work, and it is said that any one of these boats will readily plow through twelve inches of solid ice. The boats are built of iron, including the wheel boxes, and were designed under the supervision of Captain H. E. Melville, who has since had charge of their maintenance. The following are the dimensions of the boat shown. Extreme length, 216 feet; length on load line, 200 feet; extreme width, 72 feet; beam moulded (hull), 34 feet; depth, 17 feet. She has two independent condensing engines of 3,300 total horse power, and eight Scotch boilers, each 10 feet in diameter and 9 feet 6 inches long. Her coal consumption is 3,960 pounds per hour, and she has a crew of thirty-one men.

During the present winter all these boats have been in active service, but they were not in use at all last year. Each boat has its own work laid out for it. No. 1 patrols the Delaware and Schuylkill fronts and the Horseshoe, at the lower end of the city. It is at this latter point the most difficulty is met, the ice here becoming jammed by the recurring tides so that few vessels can pass through it unless convoyed by the ice boat. Boat No. 2 keeps the channel open between Fort Mifflin and New Castle, and No. 3 plows her way from the head of the bay to the breakwater. The trip of one of these boats makes a most interesting picture. Following closely in her wake is a fleet of steamers and sailing craft under tow of tugs, and frequently large fleets of oyster boats and fishing vessels bring up the rear. No charge is made for the service of the boats unless a tow is required, which service is not given unless the ice should be too heavy for the ordinary tugs.



THE PHILADELPHIA ICE BOATS CLEARING THE CHANNEL ON THE DELAWARE RIVER.

Gasoline Engines.

Says a writer in Milling: The word gasoline suggests danger in the minds of many. It is nevertheless a fact that fewer accidents occur with gasoline engines than with steam power. The very fact that insurance rates are considerably less where gasoline engines are used is evidence that they are less dangerous. It has been but a few years since this type of engine was built in small sizes only, and were not intended to drive machinery of any great magnitude. At the present time, however, they are built in sizes considerably larger than 100 horse power.

It is not many years since it was generally thought that the gasoline engine was doomed, that it would soon be obliged to give way to the electric motor. There are numerous objections to the electric motors. In the first place the expense of current is greater than the public had expected it to be. While the motor itself is a simple affair and not likely to get out of order, the machinery at the power station is likely to meet with a serious breakdown and without a moment's warning. Such breakdown during the busy part of the day is a matter of no small consideration. It is said that the shutdowns for repairs to the machinery or the line, the latter particularly, as it is exposed to many risks—fire being the most annoying—are not more numerous or otherwise damaging than those which occur in the small independent plant, but it is a peculiarity of human nature to experience less exasperation with trouble from a domestic than from an outside source. Another inconvenience of the electric motor is that it cannot be used even a little after the hour for current to be shut off without nearly double the expense. One may require power but a few hours during the day. Were it not for the city ordinances requiring a licensed operator for every steam engine plant, large or small, the electric motor would have made even less progress than it has. Nearly all the objections are overcome by the engine which can be operated with the gas from the city retorts or made from gasoline on the spot. It can be used at any time. When not in use it is not an expense. It requires no licensed operator.

The advantages claimed over steam engines are also quite numerous. Every one knows the tedious preparations required before starting a steam plant and the constant care and anxiety to keep engine, boiler, pump, heater, and piping in order. There is frequently an endless amount of trouble in cold weather on account of pipes freezing. One of the great advantages which the gasoline engine possesses is that it can be operated with a reasonable amount of regularity. The fuel can be turned on and safely relied upon that it will be delivered with a certain degree of regularity. There are many cases where the engine is practically allowed to take care of itself for a half a day at a time. We have only to observe the smoke rolling out of the tall smokestack to be convinced that at times a great deal of coal is being wasted, and heat as well, and that the engines will have to hold back for a time in order to retain the standard number of revolutions. Every mill and elevator man has learned to appreciate a regular speed. Taking everything into consideration, it is quite probable that the next ten years will witness the development and use of gas engines to an extent little dreamed of by the average person.

Dangers in the Pocket.

If the reports in several papers recently are to be credited there may exist considerable danger, of which the public should be warned, in the act of carrying in the same pocket certain articles which are in popular request, but which together, as would appear to have been demonstrated, may form a firework ready to "go off" on the slightest provocation. Thus it seems that the simultaneous occurrence of a safety match box and chlorate of potash lozenges in the same pocket led to a series of small explosions, setting fire to the clothes of the unfortunate wearer and severely burning his legs. It is a well known fact in chemistry, of course, that red phosphorus—one of the constituents of the safety match box rubber—combines with explosive violence with chlorate of potash; but the possibility of such a reaction taking place in a person's pocket has not been foreseen, although, on reflection, we easily see that in these materials there occur two powerful elements—oxygen and phosphorus—which simply yearn, so to speak, to combine. This effected, the lively combustion of the sugar of the lozenge would follow as a logical but very unpleasant sequence. When, therefore, a chlorate of potash lozenge is placed in the same pocket as the safety match box, the pocket is unwittingly converted into a miniature magazine for fireworks, which, if they happen to "go off," cannot certainly be for anybody's "benefit." In any case, a person commits a breach of sanitary law surely when he keeps soothing medicaments in the uncongenial company of a safety match box.—Lancet.

The Phonograph in Typography.

As a matter of interest, Sir B. W. Richardson mentions that the first article in the current issue of the Asclepiad, occupying some twelve pages, was dictated by him into Messrs. Hazell, Watson, and Viney's phonograph. The operation occupied rather more time than reading the same article aloud from print, but yet was surprisingly rapid, and the compositor set up the type from the phonographic "echo" with extraordinary correctness.

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[BOSTON COMMONWEALTH.]

Latest News From Mars.

Mr. Lowell's four lectures on the planet Mars were heard by crowded audiences of people who filled every seat and all the standing room in Huntington Hall. For once, we got the very latest advices from that planet. The observatory in Flagstaff, as our readers know, was established by Mr. Lowell himself, and the position of Mars in the last summer gave him opportunity to make such observations as have never been made before, and to reveal to us what are marvels indeed. The result, as our readers know, is the firm conviction in his mind that intelligent beings occupy the planet Mars, who know how to work in the common good, who have contrived public works of vastly larger extent than we of the earth have dreamed of, and have carried out their contrivances with a precision and strength wholly unknown in mundane affairs.

It is impossible in print to describe the charm of Mr. Lowell's lectures. His humor, his ready wit, his complete knowledge of the subject with which he deals, are such as one has no right to expect in the same public speaker. The most serious considerations are made interesting by analogies with affairs with which we are familiar and in which we are at ease. Everybody knows how light his pen is when he writes of his travels, and his ease as a public speaker and the readiness with which he takes his audience into his confidence give an additional charm to the lectures as he reads, or rather, as he delivers them.

There are not more than twenty people in this earth who have seen what he has seen. Even some of the great observatories of the world are so situated that they have not noted the marvels which the Flagstaff observatory has revealed to us. But truth is truth, and it matters but little whether at this moment it have twenty apostles or two thousand. It is certain that the revelations which the Flagstaff observatory has made from its signal station to the world are revelations which will be accepted.

It was Mr. Lowell's good fortune to reveal the relations of what he calls so well the "oases" with which the great canals of Mars communicate. These "junctions," shall we say, where two, three, four or even seven canals meet each other, seem to be the fortunate spots on the surface of Mars where one supposes that the inhabitants live in luxury, which they have secured for themselves by the diligent work, perhaps, of ages upon ages in the past. That is to say, an "oasis"—and of the oases one dares not say how many there are; they are to be counted now by hundreds—an oasis is a circular or oval spot, perhaps of a hundred and fifty miles in diameter, of living green. Its green is so dense and dark that when we are forty million miles from it, its rich verdure may still be made out, if we have an air as clear as they have at Flagstaff. The readers of the Commonwealth must not regret that this green fades away in its season. They must remember that Boston Common to-day does not present, even to their own eyes, the same aspect with which they regarded it in July or in August. It cannot be doubted that in the period of vegetation these strong-minded and strong-limbed men have been able to lay up, perhaps, the barrels of flour, perhaps the bales of manioc, perhaps the bananas or oranges, with which in the long winter of Mars they shall make life tolerable and even luxurious.

Mr. Lowell, with great humor but with absolutely accurate mathematics, showed to his hearers how large and tall and strong the Martian people might be. The attraction of gravitation is only one-third what we have here. The mathematical reader will see at once, if he be an anatomist as well, that there is no reason why the men should not be nineteen feet tall and why the Venus of Milo of Mars should not be sixteen or seventeen feet high. The physical power of this man is as great in proportion, his memory of the past may be more accurate, as it would seem that his foresight for the future is more sweeping. So it is that a population quite as dense, we may believe, as the population of this world, a population which has not spent, apparently, most of its history in mutual throat cutting and constant quarreling, has achieved the marvels of irrigation and vegetation which we see upon the planet Mars to-day. EDWARD E. HALE.

RAILWAYS in Holland are carefully managed. Accidental deaths on them average only one a year for the entire country.

CLOUD PHOTOGRAPHY.

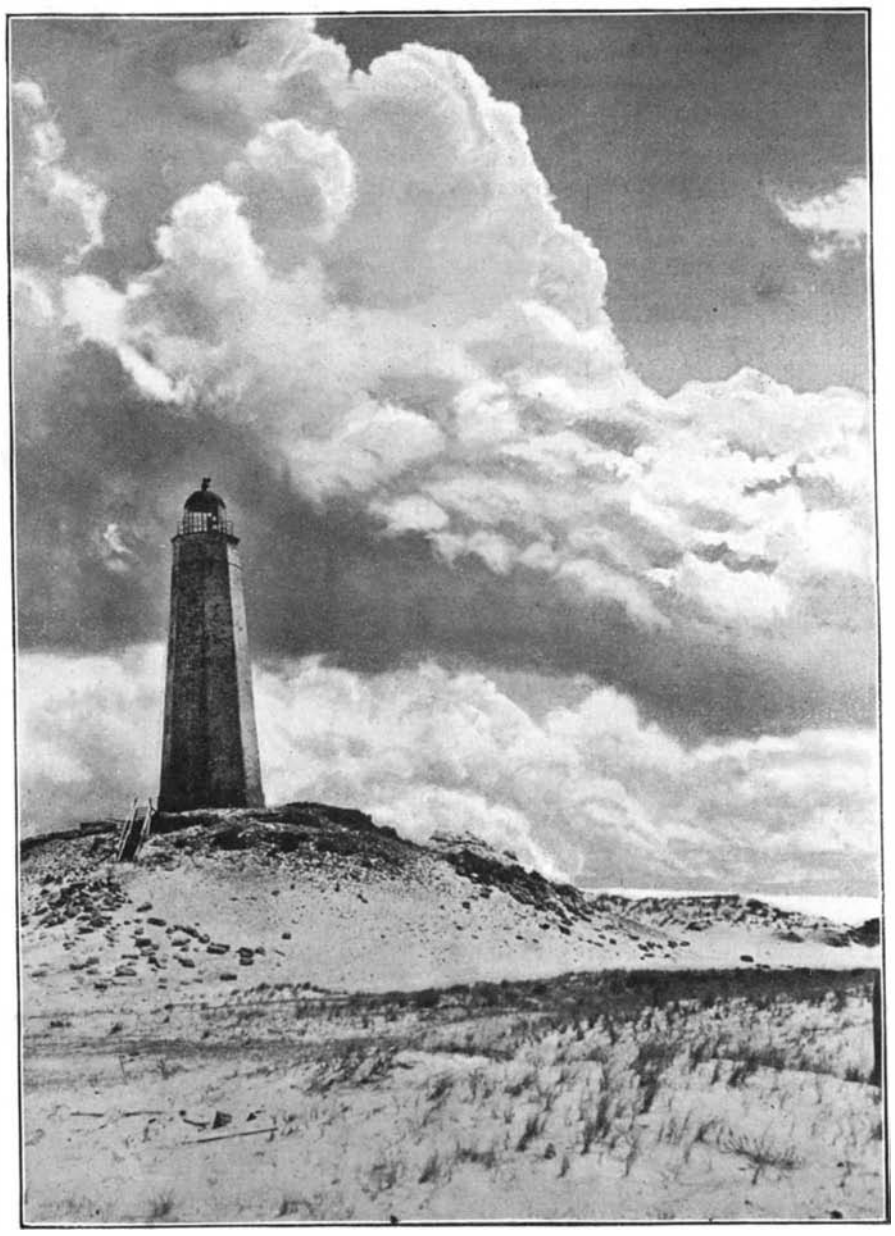
The difficulties in obtaining good cloud effects in pictures are very well known to photographers. To the majority a good photo with a fine cloudy sky is an exception, not to say an accident. We think it is not generally known that the Weather Bureau, at Washington, is constantly engaged in making meteorological photographs, cloud photography having received much attention.

ARRANGEMENT OF THE BICHROMATE CELL.

We give a half tone engraving of a cloud photograph taken by Mr. A. J. Henry, of the Weather Bureau. This print was made from a single negative taken with one exposure, and it is through the courtesy of Mr. Henry and Mr. McAdie, of this Bureau, that we are enabled to give our readers the secret of this remarkable effect.

The picture is taken through a monochromatic screen. The one found most effective is that formed of a saturated solution of bichromate of potash inclosed in a plate glass cell having parallel sides. The construction of this cell is shown in the second engraving, in which a a' are squares of plate glass and b is a ring cut from a glass tube and ground to render its edges parallel and smooth. One side of the ring is perforated and furnished with a stopper. The ring is cemented between the two glass plates with balsam of fir or other suitable cement. The saturated solution of bichromate of potash is introduced through the perforation, and the cell thus made is inserted in a piece of cork, c, which fits over the collar of the camera lens. The proper thickness for the cell is shown in the engraving; the diameter will of course vary with the size and the angle of the lens. The exposure for the negative from which our illustration was taken was four seconds.

We have no doubt this simple device will furnish the basis of many experiments for both amateurs and professional photographers.



NEGATIVE TAKEN THROUGH BICHROMATE CELL.

Riding a Wheel.

The proper position for a bicycle rider is, in the first place, an upright one, says a writer in Harper's Young People. He should push nearly straight downward with his legs—not backward, as one must do who leans far forward. His arms should not be rigid and extended to their full length, but a little bent, and the handles can be easily adjusted to bring this about. The reason for the bent or slightly bent arm is evident after a moment's thought. If the arm is stiff, rigid, and extended to its full length, the "pull" which you give the handles on going up hill, or indeed, while running along a level road, is a dead pull. There is no life in it. Each jar to the machine is a jar to your body, your head and neck, and consequently a jar to your whole system. On the other hand, if you ride with your arms a little bent, and acting as a kind of a buffer to all jarring influences, they will save you an injurious, though unnoticeable, shaking up each time you go out. The only way in which you will notice a change will be after you have become accustomed to the bent arm method. Then you will find you can ride longer without becoming tired.

Another feature of this stiff arm is the position into which the shoulders are thrust. Try it; grow a little tired with a long ride, and then see where your shoulders are. You have gradually come to lean on your arms for rest. Both shoulders have been thrown far back; your head and neck are stretched far forward, and your chest has, so to speak, sagged forward out of its natural position. Keep this up long enough, and you will be a fine-looking specimen.

No; the weight of your body should never come on the hands and arms, but on your thighs, and thence be transferred to the seat, with the unconscious, springy action of your legs, which in a measure allows some of your weight to come on the pedals. In this position your hands are free to guide your wheel, your body is erect; you do not then get into the habit of swaying from side to side to put your weight first on one side and then on the other; and your whole muscular movement is regular and normal. Try riding without putting either hand on the handles and sitting erect. If you ride well, you can easily keep your balance, and in an instant you will be in the correct position. Once in this position, place the hands lightly on the handle bars, and you will be in a healthy, a proper situation to gain benefit from your riding.

In riding ten miles, for instance, I should never go the whole distance at one pace. Slow, steady riding has its merits; so has sprinting for short distances. When a good clear road looms up ahead, have a brush for two or three hundred yards with the boy who is with you. These little races are good things. They quicken your movements and they keep you from forming bad habits or letting your body sag into set, immovable positions. They also bring the muscles into a different kind of play.

In fact, in bicycle riding, as in about everything else, you should remember that there is a right and a wrong way; that you need not only endurance, but speed, and that changing from one to another, keeping up variety, is one good way of avoiding bad habits.

THE southwest wind is the most prevalent in England. It blows on twice as many days as any other.

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Natural History Notes.

Origin of Vascular Plants.—According to Prof. Douglas H. Campbell, it is generally admitted that the origin of the vascular plants is to be sought among the less specialized Bryophytes, which were derived from algal ancestors. In the evolution of the sporophyte it gradually passed from a condition in which its entire substance was devoted to spore formation to one in which this function was more and more subordinated to the vegetative life of the sporophyte. The latter, by the development of special organs (roots and leaves), became free from the gametrophyte upon which it had lived as a parasite, the genus Anthoceros being the nearest to realizing this condition among the Bryophytes. From such a condition, several lines of development have probably proceeded, resulting in the different groups of Pteridophytes, which in turn may have independently given rise to seed-bearing plants.

Salmon and Trout.—Mr. C. S. Patterson, in a paper recently read before the Piscatorial Society, put forth the theory that the salmon and the salt and fresh water trout are simply three varieties of one and the same species, which is therefore necessarily very polymorphous. The principal arguments presented by Mr. Patterson in support of his theory were: the facts observed in the fish reared in captivity and the changes that they exhibit; the changes that occur when the surroundings are changed; a study of the individuals that live entirely in fresh water; a comparison of dwarf forms, and a comparison of the variations in the different species.

The Sheep Parrot.—Among the remarkable birds of New Zealand, says the Revue Francaise, is the greenish gray nocturnal parrot of the genus Strigops, which lives in burrows and resembles an owl, and a still more singular parrot, the Nestor notabilis, which the English have come to regard as a dangerous nuisance. The English, as well known, introduced sheep farming into New Zealand as well as into Australia. Now, these parrots have acquired the habit of perching upon the back of the sheep and excavating holes therein with their formidable bill in order to extract the kidneys. The fact is so much the more curious in that it cannot be attributed to an innate instinct; since, previous to the arrival of the English, these birds had never seen a sheep nor even any animal of analogous conformation, the fauna of New Zealand including scarcely a single mammal. We know, moreover, that in entire Oceanica there are no other mammals except marsupials. There is here, then, on the part of these birds, an act of intelligence and even of calculation, so much the more curious in that it is certainly complicated with a phenomenon of language or analogous communication. It is true that the birds are parrots, but the fact is none the less worthy of remark.

Amphibious Fish.—In an entire family of fishes, that of the Labyrinthici, inhabiting the warmest parts of the old world, we find in the branchial cavity an accessory organ of aerial respiration that permits several species to lead a partially terrestrial life. In the Anabas scandens, or climbing perch of India, Indo-China, the Malay Archipelago, and the Philippine Islands, the most celebrated fish of the group, the branchial chamber ascends very high upon the sides of the head and is divided into two cavities by a membranous partition. The lower cavity is occupied by the branchiæ, which are but slightly developed, and the upper by a foliaceous mass that has been compared to a Savoy cabbage on a small scale, which is formed of a multitude of osseous plates, variously curved, that depend from the upper pharyngeal bones. These plates are covered with a membrane well supplied with blood vessels, and the cavity that contains them debouches above the branchiæ by a narrow orifice. The complication of this labyrinth continues to increase with age, as has been shown by Gunther.

It was thought for a long time that this apparatus was a sort of sponge designed to keep the branchiæ always in a sufficient state of humidity; but it is now known, from the researches of Semper and Day, that the labyrinth never contains anything but air, and that, physiologically, it must be compared to a true lung.

It will be seen that, provided with such an organ, the Anabas is capable of leading a life as terrestrial as that of many batrachians. Numerous observations prove, in fact, that it leaves the water voluntarily and ascends to terra firma, where it remains for a very long time, crawling along by the successive inflexions of its body. It seems even to make its exit regularly from the aqueous medium every night. It likewise climbs trees by maintaining itself with its serrate opercula and the spines of its fins. From this habit and its resemblance to a perch is due its English name of climbing perch, and its Tamal name of pannei-evi, or "tree mounter." When the marshes dry up, hundreds of these fish undertake long voyages overland in search of new pools of water. Finally, they are capable of living in earth that is thoroughly dry, by taking refuge in holes, and it is by digging into the dry bed of the marshes with picks that the Hindoos unearth them at this period.

The other Labyrinthiforms, the Spirobranchus, Ctenopoma, Osphronemus (gourami), Macropodes, etc., are doubtless capable of resisting asphyxia better than other fish, but they do not seem to be as amphibious as the Anabas. Moreover, their labyrinthiform apparatus is infinitely less perfect than in this type.

Nocturnal Habits of the Bass.—A paper on the habits of the black bass, by Mr. A. N. Cheney, has called forth some interesting and valuable facts from other observers. Dr. Alfred Hinde, of Chicago, gives some information in relation to these fish developed by microscopic observations of the retinæ of the eyes of large-mouthed black bass. He concludes that they are unable to swim about after dark on account of the histological character of the bacillary layer of their retinæ, which consists solely of cones. Dr. Hinde bases his conclusions on the fact that birds of nocturnal habits have only rods in the bacillary layer of their retinæ. Animals of mixed habits, of which man is one, those which see well in high and low degrees of illumination, have a mixture of both rods and cones. On account, therefore, of the absence of rods in the retina of the eye of the large-mouthed variety of black bass, Dr. Hinde thinks that it cannot swim about in the dark. While these deductions are apparently conclusive, it would be interesting to know how under such conditions black bass are enabled to protect their young at night. That the fry have nocturnal enemies cannot be doubted. The catfish, or bullhead, which is generally supposed to be a night feeder, is one of them. A microscopic examination of the retina of the eye of the catfish might reveal some facts, whether its habits are nocturnal or not.

Influence of Food Upon Insect Organs.—Mr. J. T. Cunningham, in Nature for September 27, 1894, referring to Weismann's statement that the bee has the specific property of responding to imperfect nutrition in the larval state by an imperfect development of the ovaries, and that, as proof of this, blowflies from maggots partially starved, but fed exclusively upon meat like those which were not starved, laid eggs in normal abundance, calls attention to the fact that the larva of the worker bee is supplied with a diet low in nitrogen, while that of the queen bee is supplied with one highly nitrogenous. Evidence is required that the larva of the blowfly can fully develop its ovaries when deprived of nitrogenous food. He points out that Weismann himself, in one of his notes, shows that when blowflies were fed upon carrots and sugar they laid no eggs for more than a month, but as soon as meat was supplied them sucked it greedily and laid great numbers of eggs the week afterward. He further shows that in the case of termites, Grassi has found that the fertile individuals are fed during development on the secretion of the salivary glands of other individuals, while sterile forms are supplied only with macerated wood dust.—Insect Life.

The Work of Bees.—A writer in the Revue des Sciences Naturelles makes the following calculations in regard to the work done by the honey bee:

When the weather is fine, a worker can visit from 40 to 80 flowers in six or ten trips and collect a grain of nectar. If it visits 200 or 400 flowers, it will gather 5 grains. Under favorable circumstances, it will take a fortnight to obtain 15 grains. It would therefore take it several years to manufacture a pound of honey, which will fill about 3,000 cells.

A hive contains from 20,000 to 50,000 bees, half of which prepare the honey, the other half attending to the wants of the hive and the family. On a fine day, 16,000 or 20,000 individuals will, in six or ten trips, be able to explore from 300,000 to 1,000,000 flowers, say several hundred thousand plants.

Again, the locality must be favorable for the preparation of the honey, and the plants that produce the most nectar must flourish near the hive. A hive inhabited by 30,000 bees may, therefore, under favorable conditions, receive about two pounds of honey a day.

The Traveler's Tree.—Among the useful plants of Madagascar, mentioned by a writer in Le Genie Civil in an article upon that country and its products, is one belonging to the same order as the banana (Musaceæ) and called by the French Arbre de Voyageurs. The plant, scientifically, is the Urania speciosa. It obtains its common name from its serving to refresh thirsty wayfarers. The rain, in falling upon its leaves, flows in part into the peduncles, which, by reason of being wide and curved upwardly at the base, serve as a sort of trough in which the water is preserved until the end of the dry season. It suffices to slit the trough with a knife blade in order to obtain at once an abundant flow of water.

The Heredity of Acquired Characters.—Mr. Tegetmaier, says the Revue Scientifique, having undertaken to improve the Jerusalem artichoke, endeavored to obtain tubercles that should be perfectly globular and to eliminate such as were irregular or badly formed. He made a careful selection for several years, using as reproducers only such tubercles as were irreproachable as regards shape. He has now attained his object, and his entire planting yields him no tubercles but such as are perfectly round and regular. This is a proof to be added to those that are already so numerous of the influence of selection, and Mr. Tegetmaier observes that "it will require much influence and eloquence on the part of certain scientists to convince practical men that acquired characters are not hereditary."

A Chance for Inventive Minds.

The board convened by Secretary Herbert to consider the subject of dispensing with wood in the construction of the naval ships now building, and also to find some suitable substitute for wood in places where it is impracticable to use metal, and of which board Commander Bradford is senior member, is making fair progress. Since the naval action fought off the mouth of the Yalu River between the Chinese and Japanese fleets, in which several ships were disabled and thrown out of action by serious fires on board, the subject has received much attention at home and abroad.

The German Admiralty has convened a board to find some proper substitute for wood, and in the meantime the use of wood has ceased altogether, even the furniture being made of iron, and cork used where a non-conductor is absolutely necessary. The English are casting about for some substitute for wood, and the French have for a long time used a minimum of wood.

Owing to the conducting properties of iron and steel, the living quarters, if not sheathed with some non-conductor, become intensely cold in winter and very hot in summer. Where heat is applied, owing to the difference of temperature on the opposite sides of the metal plating, much condensation of moisture occurs. These difficulties cause rheumatism and pulmonary diseases. Clothing kept in metal drawers and lockers becomes ruined from moisture, and the drawers must be lined with something in the nature of wool or thick felt.

Briefly, a substitute for wood should have the following properties: It should be light, or no heavier than wood, non-conducting and non-combustible, and when struck by shot should not fly into splinters. In wooden ships frequently as many persons are wounded by splinters as by shot.

A solution of the problem, in the opinion of the board, seems to be in the following direction: Take something in the nature of cheap wood or vegetable fiber and fine sawdust, treat them chemically with some insoluble fireproof substance, not too heavy, then press and roll into boards, more or less dense, according to the use for which the material is desired. Such a material will be non-inflammable all through, will not splinter, will not be heavy, and will be a non-conductor. Possibly this artificial board can be strengthened by inclosing within it a tough, fine wire netting.

If sawdust or other fine cellulose material, after being rendered non-inflammable, can, by mixing with other materials not too heavy, or, if heavy, in small quantities, be applied to metal in a plastic state so as to harden into a compact mass impervious to water, then it will be of great value. In other words, if a light, non-conducting, non-inflammable, insoluble cement can be discovered, it may be of great use in ship construction.

The Steam Shovel.

The primary object of the steam shovel is to supersede hand labor in shoveling; but with the advent of the steam shovel came increased and multiplied opportunities for its use, and it is now doing work which by hand labor would have been impossible. Inasmuch as in nearly all cases the material to be shoveled or excavated has to be hauled away, the chief function of the steam shovel is to dig the material and load it on cars. At first wagons drawn by horses were used, and are still used in certain cases, but the wholesale manner in which the shovel digs makes it necessary to take away its product by train loads in rapid succession rather than by wagon loads. It is in this capacity and in its tirelessness in maintaining it that the economy of the machine over manual labor is manifest. The average laborer can shovel from a bank of fairly loose earth into a car or wagon five feet high not over four cubic yards or six tons per ten hours, and where the material is at all hard or compact much less than this is accomplished.

Assuming a laborer's wages to be $1.50 per day, the cost of loading the cars will be 37½ cents per cubic yard, or 25 cents per ton. If plowing, picking, or blasting is necessary, the cost of placing the material on the cars may be $1 per cubic yard or over. The steam shovel, on the other hand, will dig and load as much as 1,500 or 2,000 cubic yards, equal to from 2,250 to 3,000 tons, in the same time, and this with the labor of six men, three on the machine and three to lay its track as it progresses. To do 2,000 cubic yards in the same time, at four yards per day per man, would require 500 men, so that with a single powerful steam shovel six men can do the work of 500.

These figures are startling facts, and, although they will necessarily vary greatly with different conditions and in material of different degrees of hardness, they exhibit strikingly the marvelous superiority of this form of steam labor over hand labor.—A. W. Robinson, in Cassier's Magazine.

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Different Kinds of Money Recognized by the Government as Legal Tender.

Although people talk glibly and wisely about the national currency, the vast majority of them have but a superficial knowledge of the functions of the various issues. On account of the present general discussion on the subject, a few facts are briefly given that may afford a clearer understanding of the present condition of the national finances.

The official definition of the term "legal tenders" is "money of a character which by law a debtor may require his creditor to receive in payment, in the absence of any agreement in the contract or obligation itself." In government transactions the gold coins of the United States are a legal tender in all payments, at their nominal value, when not below the standard weight and limit of tolerance provided by law for the single piece, and when reduced in weight below such standard and tolerance are a legal tender at valuation in proportion to their actual weight.

Standard silver dollars are a legal tender at their nominal value for all debts and dues, public and private, except where otherwise expressly stipulated in the contract. The silver coins of the United States of smaller denominations than $1 are a legal tender in all sums not exceeding $10 in full payment for all dues, public and private.

Minor coins, whether of copper, bronze or copper-nickel, are a legal tender at their nominal value for any amount not exceeding twenty-five cents in any one payment.

United States notes, otherwise known as "legal tender notes" and "greenbacks," are a legal tender in payment of all debts, public or private, within the United States, except duties on imports and interest on the public debt.

Treasury notes, issued in payment of purchases of silver bullion under the Sherman act of 1890, are a legal tender in payment of all debts, public or private, except where otherwise expressly stipulated in the contract, and are receivable for customs, taxes and all public dues.

Columbian half dollars are a legal tender to the same extent as subsidiary silver coin—that is, $10 in any one payment. Columbian quarters are also a legal tender to the same extent as subsidiary silver coin.

Gold certificates are not a legal tender. They are, however, receivable for customs, taxes and all public dues. Silver certificates have precisely the same standing as gold certificates.

National bank notes are not a legal tender. They are, however, receivable at par in all parts of the United States in payment of taxes, excises, public lands and all other dues to the United States, except duties on imports; and also for all salaries and other debts and demands owing by the United States to individuals, corporations and associations within the United States, except interest on the public debt and in redemption of the national currency.

Trade dollars are not a legal tender. By the act of February 12, 1873, they were a legal tender at their nominal value for any amount not exceeding $5 in any one payment, but under date of July 22, 1876, it was enacted that they should not thereafter be a legal tender.

By the act of March 3, 1863, fractional currency was receivable for postage and revenue stamps, and also in payment of any dues to the United States, less than $5, except duties on imports; but they are no longer a legal tender to any extent whatever.

The Treasury Department has also decided that foreign gold and silver coins are not a legal tender in payment of debts. The question has been raised and disputed as to whether what was called the "Continental currency," issued during the war of the rebellion by the old government, was or was not a legal tender. The facts appear to be that while the Continental Congress did not by any ordinance attempt to give it that character, they asked the States to do so, and all seem to have complied, except Rhode Island. The Continental Congress only enacted that the man who refused to take the money should be an enemy of his country. This currency, as now classified at the Treasury Department, is not a legal tender.

By law, Treasury notes are redeemable in coin. The kind of coin employed is optional with the Secretary of the Treasury. Secretary Carlisle has directed their redemption in gold whenever that coin is demanded. In case the holder has no preference, he will receive silver in exchange, but such cases are extremely rare. United States notes are also redeemable in gold.

There is no standard in the matter of government bonds. Each loan stands on its own bottom. During the war legal tender notes were accepted in payment for bonds, but since then all government loans have been negotiated in gold or its equivalent—gold certificates. The recent issues of bonds were for the purpose of replenishing the dwindling gold reserve, in order to enable the government to maintain the parity of the two metallic standards of value. Consequently, no other currency was receivable in payment of the bonds. Bonds are redeemable in coin, either gold or silver, at the option of the government.—Evening Telegram.

FENNECS IN THE BERLIN ZOOLOGICAL GARDEN.

We publish herewith an engraving—for which we are indebted to the Illustrirte Zeitung—of some little fennecs (Canis zerda) reared in the Berlin Zoological Garden. The parents were brought from the Sahara in Tunis, and they are the first of these delicate children of the desert that have lived for a length of time in captivity. Great surprise has been expressed that the young ones have been successfuly raised.

At first the little things, with their snub noses and rather short, limp ears, looked like pug pups. They were covered with thick light gray wool. When they were five weeks old they began to try to crawl about,

YOUNG FENNECS IN THE ZOOLOGICAL GARDEN AT BERLIN.

Drawn from life by Anna Held.

as shown in the round picture in the upper part of the engraving, but did not begin to develop their fox-like shape until they were eight weeks old, when their noses began to become pointed and their ears to grow longer, and soon the little creatures tried to hold their ears stiff. Then they left their mother's side to play together, and soon learned to chase a live mouse when one was given to them, playing with it as kittens would. They grew very fast, and in ten weeks were almost as large as the old fennecs, but their tails had not yet the long, bushy hair like that on the tails of their parents. Our illustrations show clearly the changes in the shapes of the young fennecs that occurred as they developed.

London Prices of Silver, Tin, Copper and Lead.

Messrs. Vivian, Younger & Bond, London, have issued a diagram showing the prices of various metals at the beginning of each month for 19 years. The diagram is most instructive, and the fluctuations can be seen at a glance. Taking first the case of silver, the price in 1875 is shown to have been 57½d. per oz.; in 18 months it dropped 18d., recovering in six months. Since 1877 the tendency has been downward, with the exception of a sharp recovery and subsequent drop in the autumn of 1890; and now the price is 27¼d., a drop in 19 years of 2s. 6d. per oz. The influence of the Societe des Metaux is seen in the line representing copper, but the cornering was of short duration, the rise from £40 to £87 per ton lasting only 16 months—sufficient, however, for fortunes to be made and lost. The price now, £42, is only half what it was in 1875. Foreign tin has fluctuated more than the others, but still the price now, £61, compares with £95 in 1885. Tinplates have dropped 20 per cent.

A Forest 3,000 Miles Long by 1,700 Miles Wide.

"Where is the greatest forest in the world?"

The question was asked in the Forestry section of the American Association for the Advancement of Science, at its recent annual meeting. The importance of forests for equalizing the climate and the rainfall of the globe was under discussion, and the purpose of the question was to show where the great forest tracts of the world are situated.

One member, replying offhand, was inclined to maintain that the greatest continuous tract of forest lies north of the St. Lawrence River, in the provinces of Quebec and Ontario, extending northward to Hudson Bay and Labrador; a region measuring about 1,700 miles in length from east to west, and 1,000 miles in width north and south.

A professor from the Smithsonian Institution rejoined that a much larger continuous area of timber lands was to be found, reckoning from those in the State of Washington northward through British Columbia and Alaska. But he limited his statement to North America, for he added that, in his opinion, the largest forest in the world occupied the valley of the Amazon, embracing much of northern Brazil, eastern Peru, Bolivia, Ecuador, Colombia, and Guiana; a region at least 2,100 miles in length by 1,300 in length.

Exception was immediately taken to this statement by several members who, in the light of recent explorations, have computed the forest area of Central Africa in the valley of the Congo, including the head waters of the Nile to the northeast, and those of Zambesi on the south. According to their estimates, Central Africa contains a forest region not less than 3,000 miles in length from north to south, and of vast although not fully known width from east to west. Discussion, in which the evidence afforded by travels and surveys was freely cited, seemed favorable to the defender of the Amazonian forests.

Later in the day the entire question was placed in another light by a member who was so fortunate as to be able to speak from some knowledge of still another great forest region of the globe. This gentleman gave a vivid picture of the vast, solemn taigas and urmans, the pine, larch, and cedar forests of Siberia.

It appears that Siberia, from the plain of the Obi River on the west to the valley of the Indighirka on the east, embracing the great plains, or river valleys, of the Yenisei, Olenek, Lena, and Yana rivers, is one great timber belt, averaging more than 1,000 miles in breadth from north to south—being fully 1,700 miles wide in the Yenisei district—and having a length from east to west of not less than 4,600 versts, about 3,000 miles. Unlike equatorial forests, the trees of the Siberian tiagas are mainly conifers, comprising pines of several varieties, firs and larches. In the Yenisei, Lena, and Olenek regions there are thousands of square miles where no human being has ever been. The long-stemmed conifers rise to a height of 150 feet or more and stand so closely together that walking among them is difficult.

The dense, lofty tops exclude the pale Arctic sunshine, and the straight, pale trunks, all looking exactly alike, so bewilder the eye in the obscurity that all sense of direction is lost. Even the most experienced trappers of sable dare not venture into the dense taigas without taking the precaution of "blazing" the trees constantly with hatchets as they walk forward. If lost there the hunter rarely finds his way out, but perishes miserably from starvation or cold. The natives avoid the taigas, and have a name for them which signifies "places where the mind is lost."

The discussion was closed very appropriately by Prof. Fernow, of Washington, with an illustrated lecture, which showed how, in the earlier ages, forests had covered all the continental areas, and had rendered the climate equable to a degree now unknown.

At first human beings battled with the forest in a fitful manner, making small clearings for themselves; but gradually, by the aid of fire and of their own increasing numbers, they have so far prevailed in the struggle for supremacy that the forests are hopelessly conquered. But grave evils follow their extermination; and now the question is, how to foster, protect, and preserve them.—Youth's Companion.

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"Argon"—the New Gas Discovered by Lord Rayleigh and Professor Ramsay.

A large audience assembled January 31 in the theater of the University of London to hear Professor Ramsay read the paper on "Argon, a New Constituent of the Atmosphere," communicated to the Royal Society by Lord Rayleigh and himself. The London Times says:

The meeting was noteworthy as being the first devoted to the discussion of a single subject and thrown open to the general public. In a former paper it had been shown that nitrogen obtained from chemical compounds is about one-half per cent lighter than atmospheric nitrogen. A great many experiments were described made upon nitrogen obtained from various sources. The details of these experiments have no interest for the general public, but the result is to show that nitrogen, from whatever chemical source it may be derived, has a constant density, differing from the density of atmospheric nitrogen by a constant quantity. It whatever way the atmospheric nitrogen may be separated the result is the same, and it was to solve the interesting problem thus presented that Lord Rayleigh and Professor Ramsay embarked upon the laborious experiments which have led to the discovery of a hitherto unrecognized substance. As that substance exists in great quantity in the atmosphere, it is decidedly singular that it has been so long overlooked, and all the more so when we consider that it was undoubtedly isolated by Cavendish, although neither he nor those who have followed him observed the significance of the irreducible gaseous residue from his classical experiment. When the discrepancy in weights between chemical and atmospheric nitrogen was first encountered, attempts were naturally made to explain it by contamination with known impurities, but finally it became clear that the difference could not be accounted for by the presence of any known impurity.

By considerations drawn from the ratio of specific heats, the authors are led to regard argon as a monatomic gas like mercury, and its atomic weight is therefore not 20, but 40. The substance is thus removed from among electro-negative bodies like fluorine, where its density would seem to locate it, to a place among such metallic bodies as potassium and calcium. This gets rid of a serious difficulty, but involves the hardly less formidable one of grouping it with such apparently dissimilar bodies as those just mentioned. In this dilemma the authors are almost disposed to regard argon as a mixture of two unknown elements. However, balancing arguments for and against, they seem, on the whole, to incline to the belief that argon is a single element; but the conclusions which follow are, they admit, of a somewhat startling character. Many attempts have been made to induce it to combine, but they have all as yet proved abortive. In dealing with a substance of so absolutely inert and exceptional a character speculation must necessarily proceed upon rather abstract lines. So far as we have reached at present, argon stands entirely unrelated with any other substance in nature, and every theory of its constitution must accordingly be accepted with extreme caution. As to its physical properties, we have a little more information. Its solubility in water is relatively high, being 2½ times as great as that of nitrogen. Its spectroscopic examination has been conducted by Mr. Crookes, who contributed a supplementary paper dealing with that portion of the subject. It has two distinct spectra, as has nitrogen itself. But while the nitrogen spectra are of different characters, one being a line and the other a band spectrum, the two spectra of argon are of the same type. According to Professor Olszewski, of Cracow, the critical point of the new gas is— 121 degrees; the critical pressure, 50·6 atmospheres; the boiling point, —187 degrees; the melting point, —189·6 degrees; and the density of the liquid, 1·5.

Professor Armstrong, President of the Chemical Society, said that the case for the existence of the new constituent was strong, though it had not been brought forward in such logical order as it might have been. There was a body of evidence that there is in the atmosphere a constituent which has long been overlooked. Nitrogen was regarded as a very inert form of matter, and apparently argon was like it, only more so. Conceivably it was diatomic; the atoms might be so firmly connected as to take no notice of anything but each other. The spectroscopic evidence did not justify the conclusion that argon is a mixture of two gases—a point upon which Mr. Crookes evidently wavered.

Professor Rucker, President of the Physical Society, said that beyond all question a new constituent of the atmosphere had been discovered.

Lord Rayleigh observed that, though not unaccustomed to difficult investigations, he had never had a harder task than that which he had carried through with the assistance of Professor Ramsay. He discussed shortly the evidence which seemed to him and his colleague to lend high probability to the belief that the new substance resembles mercury in being monatomic. He found it difficult to conceive how two atoms could be so intimately combined as to suit a diatomic theory of its constitution, but did not deal with the difficulties involved in supposing it monatomic.

Lord Kelvin joined the presidents of the Chemical and Physical Societies in congratulating the authors on the brilliant success of their investigations.

Remarkable Volcanic Eruption.

Details of the remarkable volcanic upheaval which occurred recently on Ambrym Island, in the New Hebrides, have been published in the Sydney Morning Herald, furnished by an officer of the British warship Dart, who says:

"We were lying off Dip Point on the morning of the 16th of October last when it broke out. We steered along the southeast coast, and could then see a dense mass of smoke arising near Benbow Mountain, and could hear a heavy rumbling sound just like distant thunder. In an hour we were abreast where the stream of rushing lava was making its way through the forest of trees. As it came on, filling up valleys on its course toward the sea, the rush and roar became louder. Every now and then, amid the dense smoke caused by the lava setting fire to everything, would arise a volume of steam as it rushed into the streams of water. The lava stream must have traveled several miles before reaching the sea, which it did, completely sweeping the cliff away for about 30 yards wide. It rushed into the sea with a tremendous roaring and hissing noise, and sent up an immense volume of steam until it reached a height of 5,000 or 6,000 feet."

A New Treatment of Whooping Cough.

Lyon Medical for January 13 publishes an abstract of an article from the Medecine Moderne for December 26, 1894, in which M. De Chateaubourg describes a new treatment of whooping cough, which consists in injecting, subcutaneously, two cubic centimeters and a half of a ten per cent solution of guaiacol and eucalyptol in sterilized oil. After the third injection the fits of coughing diminish noticeably, the appetite returns, and, as the vomiting rapidly ceases and the general condition begins to feel the good effects of the treatment, the whooping cough disappears at the same time. The author reported five cases.—N. Y. Med. Jour.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

BRAKE.—Simon P. Mitchell and Carl L. Schuppe, Van Buren, Ark., and Max B. Schuppe, New York City. These inventors have devised a mechanism which may be set for the control of the brakes from the engine, or operated by the ordinary hand brake shaft, and set by the shaft to operate automatically, the mechanism being applicable to either freight or passenger cars. Pivoted levers are connected with spring pressed buffers, a rod connecting the levers, while a second set of levers connected with the brakes is engaged by the connecting rod, the rods having one end secured to the levers and their other ends slidably connected with the buffers.

Electrical.

CUT-OFF MECHANISM FOR STAND PIPES.—Robert McGowen, Washington, Ind. Two patents have been granted this inventor, one relating more especially to cutting off the pumping engines when the water reaches a certain height in the pipe, the cut-off being automatically effected by the water through electro-mechanical means, and the devices being automatically reset to normal position after the cut-off has been effected. Connected with the cut-off valve is a magnet and reciprocating bar moved in one direction by gravity, a trigger mechanism holding it elevated, while a counterbalance actuated by the stand pipe overflow releases the trigger. The other invention relates more particularly to cutting off the stand pipe from the water mains which have fire plug laterals, whereby the full pressure in the main may be instantly utilized in case of fire, the stand pipe being again placed in communication with the main when desired. It provides a combined electrically and gravity operating mechanism for cutting off the main from the stand pipe, electro-hydraulic operating means for restoring the mechanisms to their normal position, and mechanically operated tripping devices operated by the cut-off means. The entire operation of turning off or turning on the valve in the stand pipe lateral, as well as the automatic resetting of all of the mechanism, can be effected by a mere turning of the crank of an electro-magnet to energize the electric operating devices.

Mining, Etc.

CANDLE HOLDER, CRIMPER, AND CUTTER.—Andrew J. Carter, Alma, Col. This is an improved miner's tool for readily cutting a fuse and crimping a cap, while also affording a convenient candle holder adapted to be driven into the mine chamber or hung on a projection from the wall. It resembles somewhat a pair of scissors with one blade, this portion being adapted to be driven into the timber of the mine, and having spring-pressed handles and jaws with cutting and crimping edges. The candle holder is held on the tool by spring attachment, having at one end an open ring for the reception of the candle, its other end being connected with a guide arm on an upward extension of which is a hook, by which the device may be hung on a projection in the mine.

DUST COLLECTOR FOR METALLURGICAL FURNACE.—Oliver R. Moffet, Grand Falls, Mo. For treating waste lead fumes to retain minute particles, this inventor combines with a settling chamber a movable strainer, flexibly held to a definite or normal position, with independent means for agitating it and dislodging the dust. The strainer is pivoted and spring-pressed, but may be rocked against the pressure of the spring by a rock shaft and shaker arm. Any desired number of strainers may be set in the settling chamber.

Mechanical.

WOOD TURNING LATHE.—David T. Matthew and Albert T. Collier, Tacoma, Washington. This invention relates to lathes with many spindles for turning polygonal forms, and the improved lathe has a revoluble head with revoluble spindles to engage one end of a series of articles to be turned, while a movable knife frame carries knives to cut on their outermost surfaces. For cutting a large number of articles of a stock pattern, the knives may be set to enable the operator to turn out the work with the greatest rapidity and in the best manner, without the exercise of special skill. The top of the knife frame forms a rest for hand tools, to enable a wood turner to cut small orders of special pattern by hand.

BOX MAKING MACHINE.—Abner Carey, Cairo, Ill. This is a machine which holds the ends and centers, if any are used, in position, while nailing on the sides and bottom of the box. It has a top plate with transverse slots for the reception of the box ends, there being in the plate movable clamping bars to clamp the ends in place. The several parts are always held in proper position for nailing without gaging or mailing, enabling the operator to rapidly complete the work.

Agricultural.

CULTIVATOR.—Rene A. Boudreaux, Pugh, La. Two side plows are employed in this cultivator to hill or ridge the earth around the roots of the plants, the plows being readily adjustable as to height and distance from the beam. Near the heel of the beam is held a sweep adapted to break up the center of the row between the plants, a colter following behind in the central furrow to assist in holding the plows to their work. This cultivator is adapted for use upon sugar cane, corn, cotton, and other crops planted in rows.

COTTON CHOPPER.—Nicholas H. Newton, Rusk, Texas. This is a machine for cultivating and at the same time thinning out the rows of plants. It has semicircular hoes, with tapered cutting edge, adjustably arranged to regulate the depth they shall enter the ground, the hoes being rotated as the machine is drawn forward by a gear connection with the axle, and acting one after the other to remove the surplus plants from the rows, properly spacing them. Adjustable plow blades are supported at the rear to cultivate the rows at each side.

PLOW, CHOPPER, AND PLANTER.—This patent is for another invention of the same inventor, providing a combination machine to open the land and plant and fertilize it, and which may also be adjusted for chopping cotton plants and cultivating rows of plants. When cotton seed is to be planted the distributer is located in the fertilizer chamber, and the furrow opener forms a smooth trough-like trench in which the seed and fertilizer are evenly distributed, the furrows being then covered by the plows at the rear of the machine, the plows also forming furrows at each side of the ridge in which the seed is located.

ROLLER COTTON GIN.—James E. Coleman, Jr., Wade, Ga. This invention relates to gins of the McCarthy type, and provides a simple and durable construction which permits of ready access to all parts for repairs and other purpose. Combined with the ginning roller is a vertically adjustable breast carrying stationary knife with concave knife edge, and operating in conjunction with this knife is a movable knife in two parts, of a combined length approximately equal to that of the stationary knife, the parts of the knife being alternately reciprocated by eccentrics on the main driving shaft. The ginning roller is adjustable relative to the vertically adjustable saddle or breast carrying the stationary knife.

Miscellaneous.

AIR PURIFYING DEVICE.—Charles Peters, Brooklyn, N. Y. According to this improvement an air pump is connected with a reservoir in which is a purifying receptacle having inlet and outlet valves, a vessel held in the receptacle containing purifying substances. As preferably arranged, the air from the compressed air reservoir passes through charcoal and then through cotton saturated with salicylic acid, or other purifying agent, before delivery from the outlet valve. The apparatus is more especially designed for use in beer and ale compressors, for supplying the beer and ale in the keg with pure air.

SPRING WINDING CRANK ARM.—Gustav A. Brachhausen, Jersey City, and Alfred Wolff, Rutherford, N. J. For preventing overwinding and consequent breaking of the springs in music boxes or other instruments, these inventors have devised a crank arm comprising a spindle or shank engaging a shaft which connects with the spring to be wound, there being a crank arm proper on and normally rotating with the spindle, but which will turn independently of it when the spring has been fully wound up. The device is very compact, and such adjustment may be made that the desired maximum tension on the spring to be wound will not be exceeded.

MAGAZINE CAMERA.—August Lundelius, Port Jervis, N. Y. This is a combined magazine hand and detective camera of simple, compact and durable construction, without loose parts or projections on the outside of the casing, although the operator may manipulate it from the outside to make either time or instantaneous exposures, bringing the plates successively into proper position for exposure. The construction permits of filling the camera with simple and independent plate carriers for glass plates or films.

RIBBON HOLDER.—Joseph S. Lyons, Pittsfield, Mass. This inventor has devised a holder or case in which rolls of ribbon of different sizes may be displayed, any of the rolls being conveniently removed as desired. Upon the inner face of the top and bottom board of the case is a longitudinal groove, and in these grooves are held longitudinal standards on which the rolls of ribbon are supported. The standards have each at one end a tubular portion in which is a spring, by which the standards are held in place, although they may be slid from end to end of the case.

DISPLAY CARD AND HOLDER.—William F. Jones, Baltimore, Md. A large field or backing card, according to this improvement, is provided with an easel support which forms a background for packages, small cards, etc., while on the front face are smaller layers of stiff cardboard, each one in front smaller than the one behind, forming a series of laps in which thin packages or cards may be stuck, more or less covering the main field card. Any one package may be taken from the support without loosening or affecting the support of the others.

VAPOR OR GAS STOVE.—Harry H. Kelley, Elyria, Ohio. This invention provides a simple and durable construction designed to utilize the heat from the burner to the fullest advantage for cooking and for heating a warming oven. It consists principally of an annular heating chamber under the stove top and surrounding the burner, the chamber having at its inner wall inlet openings for the heat and hot gas, there being an adjustable perforated curved band or damper for regulating the size of the openings.

BATH ROOM BRUSHING MACHINE.—Edwin Walkers, Amawalk, N. Y. According to this invention a framework to be fastened to the side of the bath tub has vertical guide ways in which vertically sliding brushes may be reciprocated by a pivoted lever having forwardly projecting handles, streams of water at the same time flowing down in the path of the brushes from faucets near the top of the frame. The improvement is designed to enable the bather to conveniently rub, scrub, and wipe dry the back of his body, the water being turned off and the brushes covered with towels for the drying operation.

THILL COUPLING.—Delbert B. McCapes, Vermillion, South Dakota. This is a cheap and simple device, attached to the carriage axle by the usual clip, and having at its front end forwardly projecting arms between which the thill iron is held. It is readily applied, and holds the thill or pole so that it cannot become accidentally displaced, although readily released when desired, while it also prevents rattling.

GATE.—William B. Whittenberg and Augustus L. Hawkins, Georgetown, Texas. This improvement provides for two separate pivoted gate sections adapted to be conveniently opened and closed by means of cords extended to posts a little distance off at each side of the roadway, there being at the ends of the cords counterbalanced weights. The latches are adapted to support the gates laterally at their meeting edges.

PLUMBER'S FORCE PUMP.—George W. Aldrich, Brooklyn, N. Y. This is a pump for forcing water through a sink or spout to remove obstructions, and is easily applied to the ordinary escape of the sink, bath tub, wash basin, etc., for clearing the passage. At the lower open end of the pump barrel is a hollow cone, around the lower edge of which is a rubber packing, and the barrel has ports at its sides which may fill with

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either water or air. The piston is operated until the obstructions are removed.

FOOT GEAR PATTERN.—Adolf Ehrenreich, New York City. This invention consists principally of a main or foundation plate forming the outlines of shoe patterns, and slides held adjustable on the main plate give outlines for various parts of the pattern. The improvement is readily adjustable for any size and style of shoe or other foot gear.

PENCIL OR PEN HOLDER FOR SLATES OR DRAWING BOARDS.—Philip E. Hannum, Carterville, Mo. The improved holder appliance consists of a case attached to the end strip of the frame, preferably by means of clamping flanges. The case has different compartments for the reception of a knife, rule, erasers, etc., and on its cover are serrated sections for conveniently sharpening a pencil.

CAROUSEL.—Milton T. Weston, Kenton, Ohio. This is a merry-go-round in which a number of carriages are made to revolve around a central point through the exertions of the occupants of the carriages. It is of simple, strong, and inexpensive construction, designed to be perfectly balanced in operation, and having an operative mechanism comparatively free from friction.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN BUILDING EDITION.

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1. Elegant plate in colors, showing an artist's home at Bronxwood Park, N. Y. Perspective elevation and floor plan. Cost complete $3,800. Mr. A. F. Leicht, architect, New York City. A unique design.
2. A residence at East Orange, N. J., recently completed for Geo. R. Howe, Esq. Two perspective elevations and floor plans. A pleasing design. Mr. Jas. H. Lindsley, architect, Newark, N. J.
3. A cottage at Glen Summit, Pa., erected for H. H. Harvey, Esq. Two perspective elevations and floor plans. A handsome summer cottage with some novel architectural features. Messrs. Neuer & Darcy, architects, Wilkesbarre, Pa.
4. A residence at Forest Park, Springfield, Mass. Two perspective elevations and floor plans. A combination of the Colonial style with French chateau features. Mr. Louis F. Newman, architect, Springfield, Mass.
5. "Sunnyside." The residence of Robt. S. Walker, Esq., at Flatbush, L. I. Three perspective elevations and floor plans. An exquisite design. Mr. Frank Freeman, architect, New York City.
6. A picturesque and well appointed residence erected for the late E. E. Denniston, Esq., at School Lane, Pa. Cost complete $22,000. Perspective elevation and floor plans. Mr. Geo. T. Pearson, architect, Philadelphia, Pa.
7. A residence at Nutley, N. J., recently erected at a cost of $5,800. Perspective elevation and floor plans. Mr. E. R. Tilton, architect and designer, New York City.
8. A cottage in the Colonial style at Southampton, L. I. Two perspectives and floor plans. Mr. C. H. Skidmore, architect.
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12. A cottage in the Colonial style at Cushing's Island, Me., erected for Francis Cushing, Esq. Two perspective elevations and floor plans. Cost complete $2,000. Mr. John C. Stevens, architect, Portland, Me. A unique and picturesque design for a model summer home.
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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

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(6428) B. L. T. asks: 1. Where can I obtain a table giving the safe capacity in amperes of different sizes of German silver wire? A. Use the copper wire table, taking German silver wire of 2·7 times the diameter of the copper wire given as safe. 2. How can I obtain an illustration of the conduit and grip used on the Broadway cable system? A. See SCIENTIFIC AMERICAN, No. 20, Vol. 68.

(6429) A. B. R. asks: 1. Could 2 or 3 cells storage battery be used to run simple electric motor in "Experimental Science," if so, how many plates per cell and what size? To be run 100 hours. A. Yes. Use two square feet of positive plate. 2. In cab of locomotive running, the brass eye through which bell cord passes out of cab to engine bell becomes charged apparently with frictional electricity, as it emits sparks when whistle is blown. This occurs at night in very dry cold atmosphere. The eye is insulated by the wood of the cab. Three small air pipes are very close and one large steam pipe about eight inches away. Can you explain the phenomenon? A. It is due to the production of so-called frictional electricity, exactly as in the old fashioned frictional electric machine.

(6430) C. S. B. asks (1) what size wire to use for ⅛ horse power motor for fields and armature. Also the number of sections for armature and number of loops to each coil? A. See our SUPPLEMENT, No. 600. 2. Can you give me the formula for some compound to use on tape for insulating purposes that will not dry out soon? A. If you add castor oil to shellac varnish, it will dry with extreme slowness.

(6431) H. C. L. asks: 1. Would like to be informed in the SCIENTIFIC AMERICAN how to make a cautery cell? A. Any low resistance cell will answer for cauterizing. 2. What is the internal resistance of a standard gravity battery? A. Two to six ohms is a good allowance. 3. Of a Leclanche? A. One or two ohms. 4. What size ports are necessary for cylinder 6 inches diameter, 12 inches stroke, at 40 pounds steam pressure, to make 30 strokes per minute? A. Steam ports ⅜ inch by 4½ inches, and exhaust ports ¾ inch by 4½ inches, as yours is a slow-running engine. 5. What is the rule for such a calculation? A. A good rule for ordinary speed engines is to make the steam ports 1-15 of area of cylinder, and exhaust ports twice the area of steam ports. Arrange width and length to suit any peculiarities in construction of the steam chest.

(6432) A. S. asks: Which is the best kind of glue to use for sticking paper on cast iron pulleys? A. Cast iron pulleys may be lagged with leather without the use of rivets, by first brushing over the surface with acetic acid, which will quickly rust it and give a rough surface; then attach the leather to the face of the pulley with cement composed of 1 pound of fish glue and ½ pound of common glue.

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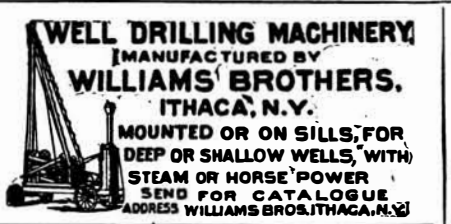
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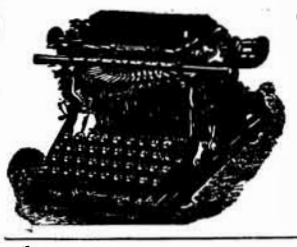

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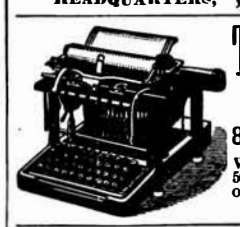

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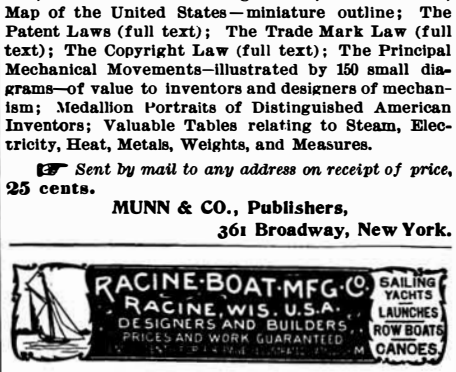

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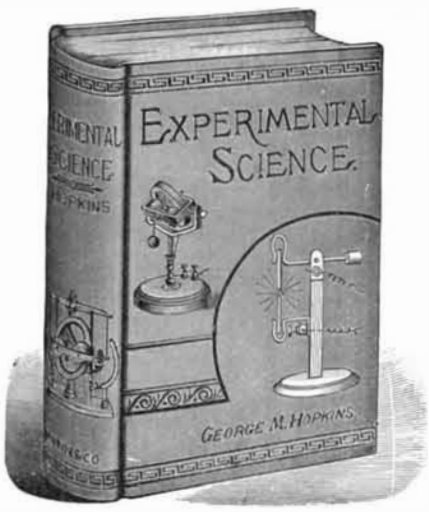

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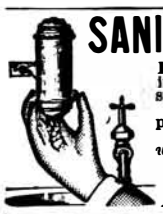

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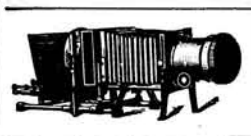

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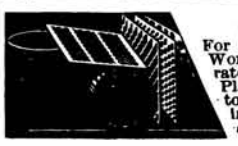

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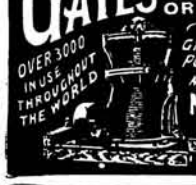

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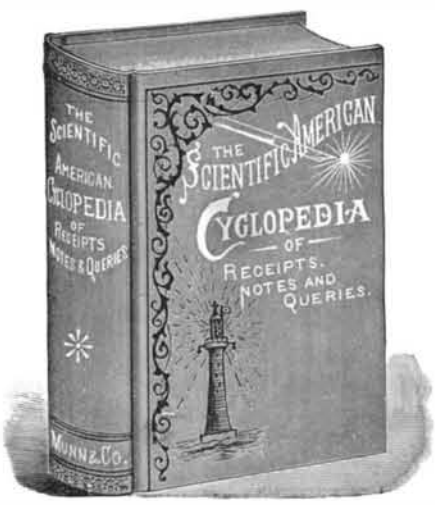

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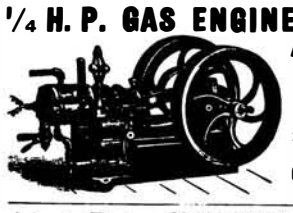

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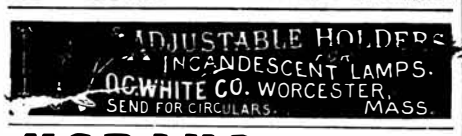

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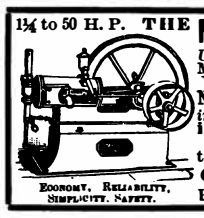

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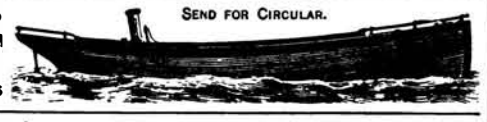

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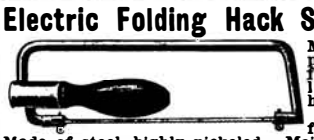

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